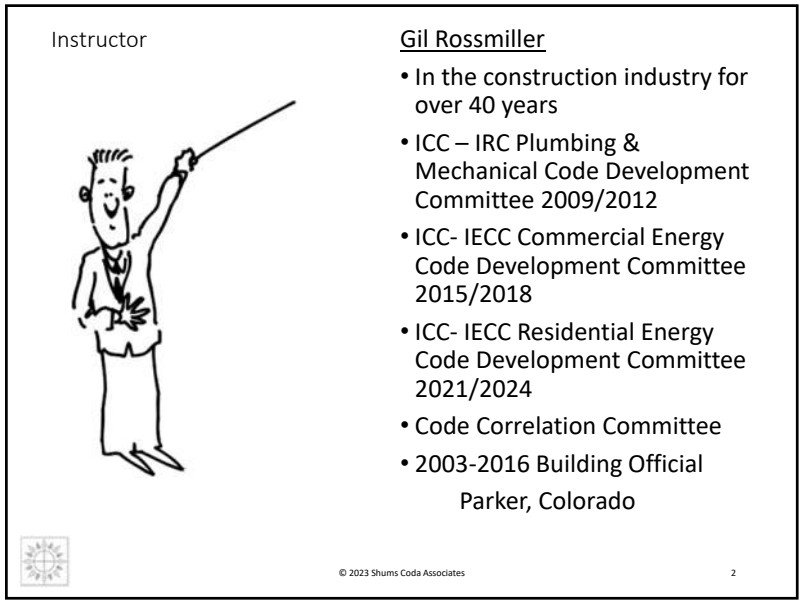
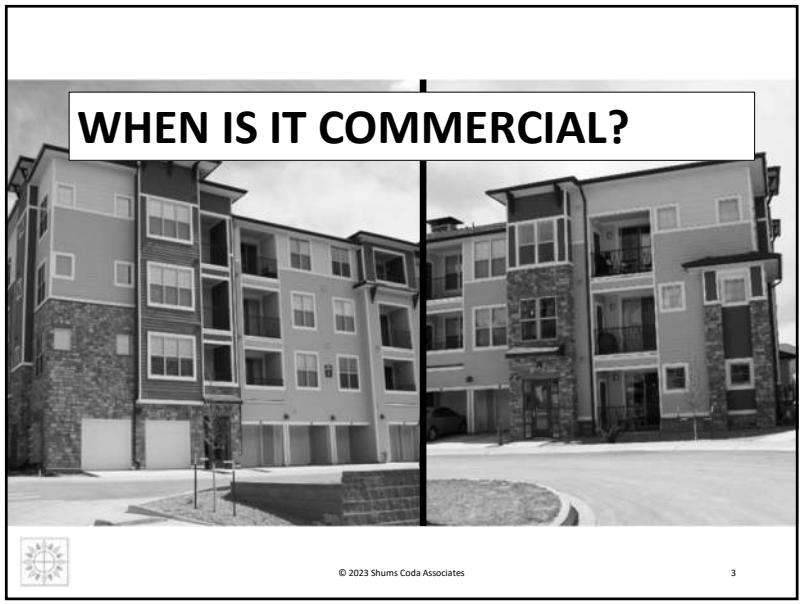
Commercial Air Barriers Air Leakage Testing

Air Leakage requirements……been there for 23 years……

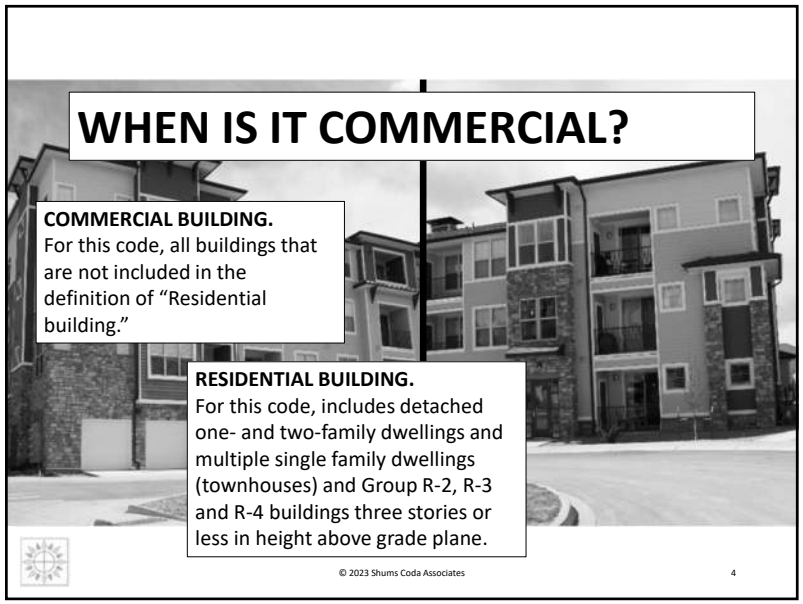
1



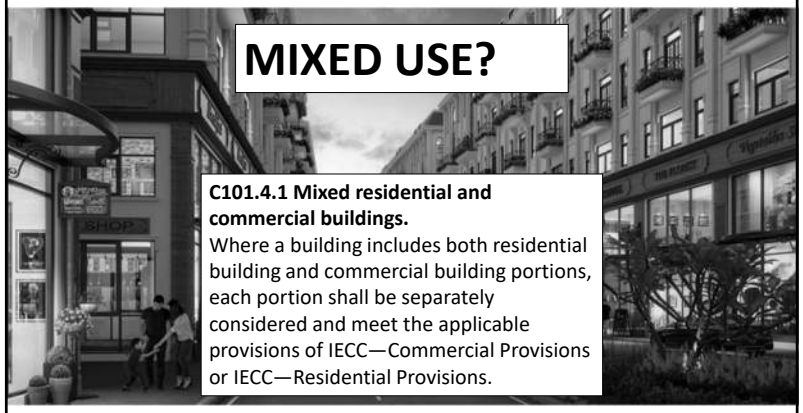
2



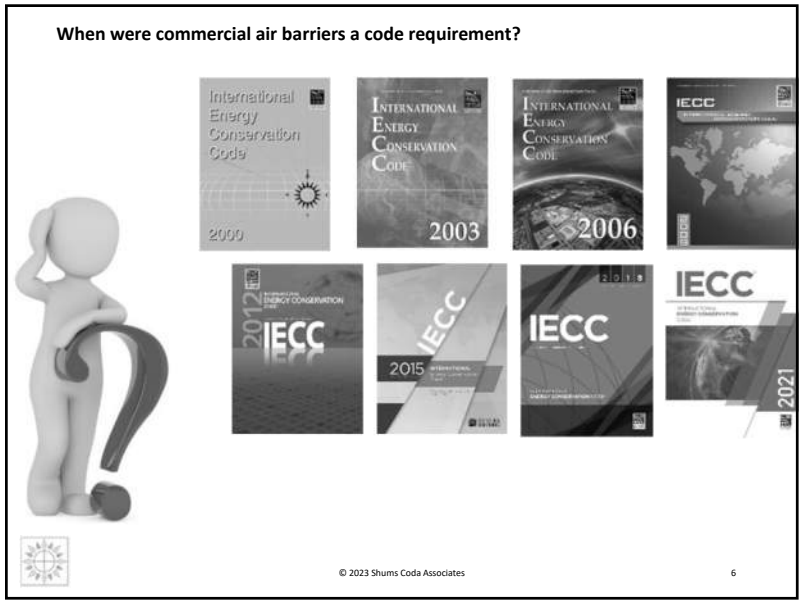
3



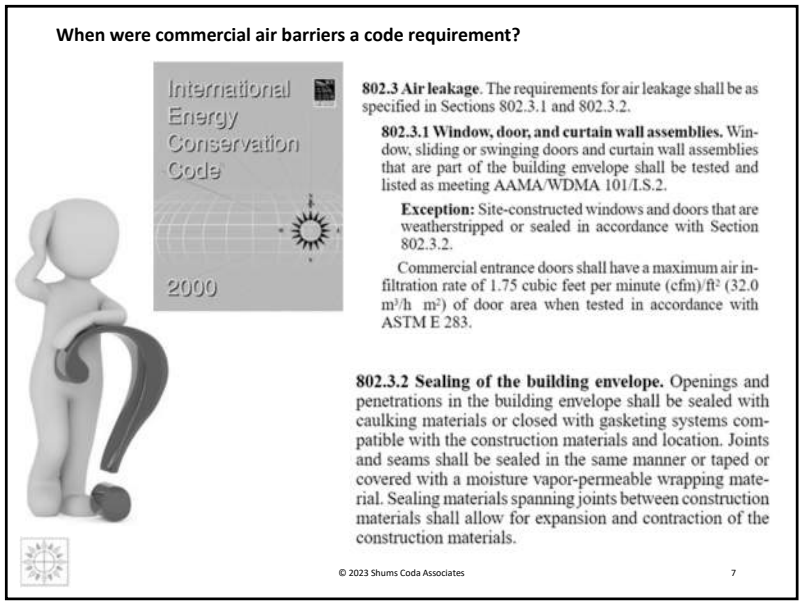
4


MIXED USE?
C101.4.1 Mixed residential and commercial buildings.
Where a building includes both residential building and commercial building portions, each portion shall be separately considered and meet the applicable provisions of IECC—Commercial Provisions or IECC—Residential Provisions.
© 2023 Shums Coda Associates
5

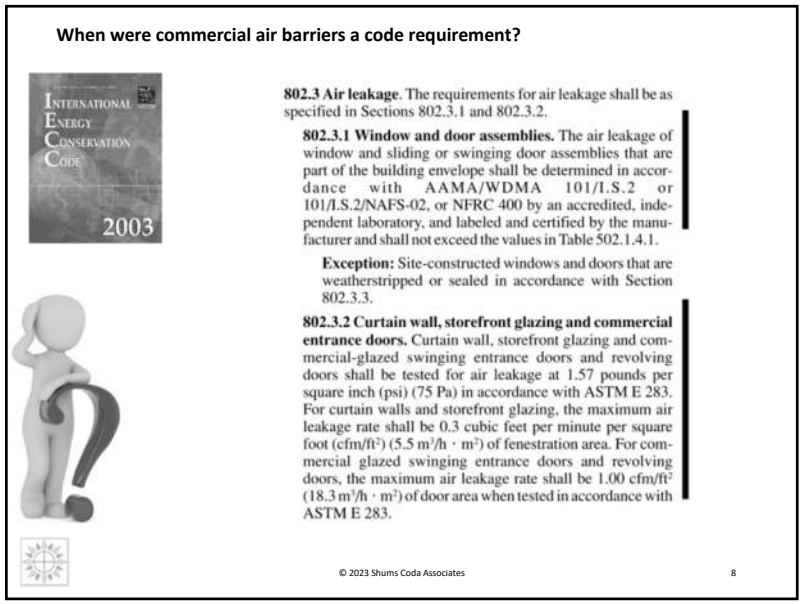
5


When were commercial air barriers a code requirement?
International Energy Conservation Code 2000
International Energy Conservation Code 2003
International Energy Conservation Code 2006
IECC
IECC 2012
IECC 2015
IECC
IECC 2021
© 2023 Shums Coda Associates
6

6


When were commercial air barriers a code requirement?
International Energy Conservation Code 2000
802.3 Air leakage. The requirements for air leakage shall be as specified in Sections 802.3.1 and 802.3.2.
802.3.1 Window, door, and curtain wall assemblies. Window, sliding or swinging doors and curtain wall assemblies that are part of the building envelope shall be tested and listed as meeting AAMA/WDMA 101/I.S.2.
Exception: Site-constructed windows and doors that are weatherstripped or sealed in accordance with Section 802.3.2.
Commercial entrance doors shall have a maximum air infiltration rate of 1.75 cubic feet per minute (cfm)/ft² (32.0 m³/h m²) of door area when tested in accordance with ASTM E 283.
802.3.2 Sealing of the building envelope. Openings and penetrations in the building envelope shall be sealed with caulking materials or closed with gasketing systems compatible with the construction materials and location. Joints and seams shall be sealed in the same manner or taped or covered with a moisture vapor-permeable wrapping material. Sealing materials spanning joints between construction materials shall allow for expansion and contraction of the construction materials.
© 2023 Shums Coda Associates
7

7


When were commercial air barriers a code requirement?
International Energy Conservation Code 2003
802.3 Air leakage. The requirements for air leakage shall be as specified in Sections 802.3.1 and 802.3.2.
802.3.1 Window and door assemblies. The air leakage of window and sliding or swinging door assemblies that are part of the building envelope shall be determined in accordance with AAMA/WDMA 101/I.S.2 or 101/I.S.2/NAFS-02, or NFRC 400 by an accredited, independent laboratory, and labeled and certified by the manufacturer and shall not exceed the values in Table 502.1.4.1.
Exception: Site-constructed windows and doors that are weatherstripped or sealed in accordance with Section 802.3.3.
802.3.2 Curtain wall, storefront glazing and commercial entrance doors. Curtain wall, storefront glazing and commercial-glazed swinging entrance doors and revolving doors shall be tested for air leakage at 1.57 pounds per square inch (psi) (75 Pa) in accordance with ASTM E 283. For curtain walls and storefront glazing, the maximum air leakage rate shall be 0.3 cubic feet per minute per square foot (cfm/ft²) (5.5 m³/h · m²) of fenestration area. For commercial glazed swinging entrance doors and revolving doors, the maximum air leakage rate shall be 1.00 cfm/ft² (18.3 m³/h · m²) of door area when tested in accordance with ASTM E 283.
© 2023 Shums Coda Associates
8

8

When were commercial air barriers a code requirement?

802.3.3 Sealing of the building envelope. Openings and penetrations in the building envelope shall be sealed with caulking materials or closed with gasketing systems compatible with the construction materials and location. Joints and seams shall be sealed in the same manner or taped or covered with a moisture vapor-permeable wrapping material. Sealing materials spanning joints between construction materials shall allow for expansion and contraction of the construction materials.

802.3.4 Dampers integral to the building envelope. Stair, elevator shaft vents, and other dampers integral to the building envelope shall be equipped with motorized dampers with a maximum leakage rate of 3 cfm/ft² [5.1 L/s · m²] at 1.0 inch water gauge (w.g.) (250 Pa) when tested in accordance with AMCA 500.

Exception: Gravity (nonmotorized) dampers are permitted to be used in buildings less than three stories in height above grade.

802.3.5 Loading dock weatherseals. Cargo doors and loading dock doors shall be equipped with weatherseals to restrict infiltration when vehicles are parked in the doorway.

 9

9

When were commercial air barriers a code requirement?

802.3.6 Vestibules. A door that separates conditioned space from the exterior shall be protected with an enclosed vestibule, with all doors opening into and out of the vestibule equipped with self-closing devices. Vestibules shall be designed so that in passing through the vestibule it is not necessary for the interior and exterior doors to open at the same time.

Exceptions:

1. Buildings in Climate Zones 1a through 4b as indicated in Table 302.1.
2. Doors not intended to be used as a building entrance door, such as doors to mechanical or electrical equipment rooms.
3. Doors opening directly from a guestroom or dwelling unit.
4. Doors that open directly from a space less than 3,000 square feet (298 m²) in area.
5. Revolving doors.
6. Doors used primarily to facilitate vehicular movement or material handling and adjacent personnel doors.

 10

10

When were commercial air barriers a code requirement?

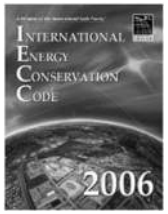
802.3.7 Recessed lighting fixtures. When installed in the building envelope, recessed lighting fixtures shall meet one of the following requirements:

1. Type IC rated, manufactured with no penetrations between the inside of the recessed fixture and ceiling cavity and sealed or gasketed to prevent air leakage into the unconditioned space.
2. Type IC or non-IC rated, installed inside a sealed box constructed from a minimum 0.5-inch-thick (12.7 mm) gypsum wallboard or constructed from a preformed polymeric vapor barrier, or other air-tight assembly manufactured for this purpose, while maintaining required clearances of not less than 0.5 inch (12.7 mm) from combustible material and not less than 3 inches (76 mm) from insulation material.
3. Type IC rated, in accordance with ASTM E 283 admitting no more than 2.0 cubic feet per minute (cfm) (0.944 L/s) of air movement from the conditioned space to the ceiling cavity. The lighting fixture shall be tested at 1.57 psi (75 Pa) pressure difference and shall be labeled.

 11

11

When were commercial air barriers a code requirement?

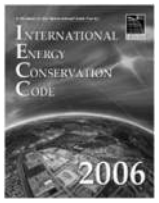


502.4 Air leakage. (Mandatory)
502.4.1 Window and door assemblies
502.4.2 Curtain wall, storefront glazing and commercial entrance doors
502.4.3 Sealing of the building envelope
502.4.4 Outdoor air intakes and exhaust openings
502.4.5 Loading dock weatherseals
502.4.6 Vestibules
502.4.7 Recessed luminaires
502.5 Moisture control. (Mandatory)

 12

12

When were commercial air barriers a code requirement?



502.4.3 Sealing of the building envelope
Openings and penetrations in the building envelope shall be sealed with caulking materials or closed with gasketing systems compatible with the construction materials and location. Joints and seams shall be sealed in the same manner or taped or covered with a moisture vapor-permeable wrapping material. Sealing materials spanning joints between construction materials shall allow for expansion and contraction of the construction materials.

502.5 Moisture control. (Mandatory)
All framed walls, floors and ceilings not ventilated to allow moisture to escape shall be provided with an approved vapor retarder having a permeance rating of 1 perm (5.7 × 10 –11 kg/Pa · s · m2) or less, when tested in accordance with the dessicant method using Procedure A of ASTM E 96. The vapor retarder shall be installed on the warm-in-winter side of the insulation.
Exceptions:
1. Buildings located in Climate Zones 1 through 3 as indicated in Figure 301.1 and Table 301.1.
2. In construction where moisture or its freezing will not damage the materials.
3. Where other approved means to avoid condensation in unventilated framed wall, floor, roof and ceiling cavities are provided

 13

13

When were commercial air barriers a code requirement?

502.4 Air leakage (Mandatory).
502.4.1 Window and door assemblies
502.4.2 Curtain wall, storefront glazing and commercial entrance doors.
502.4.3 Sealing of the building envelope
502.4.4 Hot gas bypass limitation
502.4.5 Outdoor air intakes and exhaust openings
502.4.6 Loading dock weatherseals
502.4.8 Recessed lighting
~~**502.5 Moisture control. (Mandatory)**~~ Moved to the IBC

502.4.3 Sealing of the building envelope
Openings and penetrations in the building envelope shall be sealed with caulking materials or closed with gasketing systems compatible with the construction materials and location. Joints and seams shall be sealed in the same manner or taped or covered with a moisture vapor-permeable wrapping material. Sealing materials spanning joints between construction materials shall allow for expansion and contraction of the construction materials.

 14

14

When were commercial air barriers a code requirement?

C402.4 Air leakage (Mandatory)
The thermal envelope of buildings shall comply with Sections C402.4.1 through C402.4.8.

C402.4.1 Air barriers
A continuous air barrier shall be provided throughout the building thermal envelope. The air barriers shall be permitted to be located on the inside or outside of the building envelope, located within the assemblies composing the envelope, or any combination thereof. The air barrier shall comply with Sections C402.4.1.1 and C402.4.1.2.
Exception: Air barriers are not required in buildings located in Climate Zones 1, 2 and 3.

 15

15

When were commercial air barriers a code requirement?

C402.4 Air leakage (Mandatory)
The thermal envelope of buildings shall comply with Sections C402.4.1 through C402.4.8.

C402.4.1.1 Air barrier construction
The continuous air barrier shall be constructed to comply with the following:
1. The air barrier shall be continuous for all assemblies that are the thermal envelope of the building and across the joints and assemblies.

2. Air barrier joints and seams shall be sealed, including sealing transitions in places and changes in materials. Air barrier penetrations shall be sealed in accordance with Section C402.4.2. The joints and seals shall be securely installed in or on the joint for its entire length so as not to dislodge, loosen or otherwise impair its ability to resist positive and negative pressure from wind, stack effect and mechanical ventilation.

3. Recessed lighting fixtures shall comply with Section C404.2.8. Where similar objects are installed which penetrate the air barrier, provisions shall be made to maintain the integrity of the air barrier.

Exception: Buildings that comply with Section C402.4.1.2.3 are not required to comply with Items 1 and 3.

 16

16

When were commercial air barriers a code requirement?

C402.4.1.2 Air barrier compliance options
A continuous air barrier for the opaque building envelope shall comply with Section C402.4.1.2.1, C402.4.1.2.2, or C402.4.1.2.3.

C402.4.1.2.1 Materials
Materials with an air permeability no greater than 0.004 cfm/ft2 under a pressure differential of 0.3 inches water gauge (w.g.) (75 Pa) when tested in accordance with ASTM E 2178 shall comply with this section. Materials in Items 1 through 15 shall be deemed to comply with this section provided joints are sealed and materials are installed as air barriers in accordance with the manufacturer's instructions.

 17

17

When were commercial air barriers a code requirement?

1.Plywood with a thickness of not less than 3/8 inch
2. Oriented strand board having a thickness of not less than 3/8 inch
3. Extruded polystyrene insulation board having a thickness of not less than 1/2 inch
4. Foil-back polyisocyanurate insulation board having a thickness of not less than 1/2 inch
5. Closed cell spray foam a minimum density of 1.5 pcf having a thickness of not less than 11/2 inches
6. Open cell spray foam with a density between 0.4 and 1.5 pcf and having a thickness of not less than 4.5 inches
7. Exterior or interior gypsum board having a thickness of not less than 1/2 inch
8. Cement board having a thickness of not less than 1/2 inch
9. Built up roofing membrane
10. Modified bituminous roof membrane
11. Fully adhered single-ply roof membrane
12. A Portland cement/sand parge, or gypsum plaster having a thickness of not less than 5/8 inch
13. Cast-in-place and precast concrete.
14. Fully grouted concrete block masonry.
15. Sheet steel or aluminum.

 18

18

When were commercial air barriers a code requirement?

C402.4.1.2 Air barrier compliance options
A continuous air barrier for the opaque building envelope shall comply with Section C402.4.1.2.1, C402.4.1.2.2, or C402.4.1.2.3.

C402.4.1.2.2 Assemblies
Assemblies of materials and components with an average air leakage not to exceed 0.04 cfm/ft2 under a pressure differential of 0.3 inches of water gauge (w.g.)(75 Pa) when tested in accordance with ASTM E 2357, ASTM E 1677 or ASTM E 283 shall comply with this section. Assemblies listed in Items 1 and 2 shall be deemed to comply provided joints are sealed and requirements of Section C402.4.1.1 are met.
1. Concrete masonry walls coated with one application either of block filler and two applications of a paint or sealer coating;
2. A Portland cement/sand parge, stucco or plaster minimum 1/2 inch in thickness.

 19

19

When were commercial air barriers a code requirement?

C402.4.1.2 Air barrier compliance options
A continuous air barrier for the opaque building envelope shall comply with Section C402.4.1.2.1, C402.4.1.2.2, or C402.4.1.2.3.

C402.4.1.2.3 Building test
The completed building shall be tested and the air leakage rate of the building envelope shall not exceed 0.40 cfm/ft2 at a pressure differential of 0.3 inches water gauge (2.0 L/s · m2 at 75 Pa) in accordance with ASTM E 779 or an equivalent method approved by the code official.

 20

20

When were commercial air barriers a code requirement?

C402.4.2 Air barrier penetrations
Penetrations of the air barrier and paths of air leakage shall be caulked, gasketed or otherwise sealed in a manner compatible with the construction materials and location. Joints and seals shall be sealed in the same manner or taped or covered with a moisture vapor-permeable wrapping material. Sealing materials shall be appropriate to the construction materials being sealed. The joints and seals shall be securely installed in or on the joint for its entire length so as not to dislodge, loosen or otherwise impair its ability to resist positive and negative pressure from wind, stack effect and mechanical ventilation.

 21

21

When were commercial air barriers a code requirement?

C402.4.3 Air leakage of fenestration

TABLE C402.4.3
MAXIMUM AIR INFILTRATION RATE FOR FENESTRATION ASSEMBLIES

FENESTRATION ASSEMBLY	MAXIMUM RATE (CFM/FT^2)	TEST PROCEDURE
Windows	0.20[a]	AAMA/WDMA/CSA101/I.S.2/A440 or NFRC 400
Sliding doors	0.20[a]	
Swinging doors	0.20[a]	
Skylights – with condensation weepage openings	0.30	
Skylights – all other	0.20[a]	
Curtain walls	0.06	NFRC 400 or ASTM E 283 at 1.57 psf (75 Pa)
Storefront glazing	0.06	
Commercial glazed swinging entrance doors	1.00	
Revolving doors	1.00	
Garage doors	0.40	ANSI/DASMA 105, NFRC 400, or ASTM E 283 at 1.57 psf (75 Pa)
Rolling doors	1.00	

 22

22

When were commercial air barriers a code requirement?

C402.4.4 Doors and access openings to shafts, chutes, stairways, and elevator lobbies
C402.4.5 Air intakes, exhaust openings, stairways and shafts
C402.4.5.1 Stairway and shaft vents
C402.4.5.2 Outdoor air intakes and exhausts
C402.4.6 Loading dock weatherseals
C402.4.7 Vestibules
C402.4.8 Recessed lighting

 23

23

When were commercial air barriers a code requirement?

C402.5 Air leakage—thermal envelope (Mandatory) (This is where the test option went)
C402.5.1 Air barriers
C402.5.1.1 Air barrier construction
C402.5.1.2 Air barrier compliance options
C402.5.1.2.1 Materials
C402.5.1.2.2Assemblies
~~C402.4.1.2.3 Building test~~
C402.5.2 Air leakage of fenestration
C402.5.3 Rooms containing fuel-burning appliances
C402.5.4 Doors and access openings to shafts, chutes, stairways and elevator lobbies
C402.5.5 Air intakes, exhaust openings, stairways and shafts
C402.5.6 Loading dock weatherseals
C402.5.8 Recessed lighting

 24

24

When were commercial air barriers a code requirement?

C402.5 Air leakage—thermal envelope (Mandatory)
- C402.5.1 Air barriers
  - C402.5.1.1 Air barrier construction
  - C402.5.1.2 Air barrier compliance options
    - C402.5.1.2.1 Materials
    - C402.5.1.2.2Assemblies
- C402.5.2 Air leakage of fenestration
- C402.5.3 Rooms containing fuel-burning appliances
- C402.5.4 Doors and access openings to shafts, chutes, stairways and elevator lobbies
- C402.5.5 Air intakes, exhaust openings, stairways and shafts
- C402.5.6 Loading dock weatherseals
- C402.5.8 Recessed lighting

 25

25

When were commercial air barriers a code requirement?

 26

26

When were commercial air barriers a code requirement?

 27

27

WHY?

 28

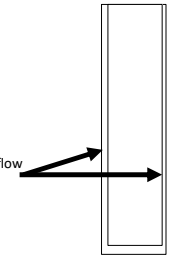
28

CONTROLLING THERMAL FLOW

Most insulation is NOT an air barrier

Resists Conduction

Does not resist Air Flow:
That is the job of the air barrier



* An Air Barrier is any solid material that blocks air flow including sealing at edges and seams

What is the biggest insulation Myth:
Insulation Stops the movement of air!

 29

29

Insulation

Insulation traps pockets of air

Stagnate Air Pockets create the R-value

Air Barrier

Stopping the movement of air from scrubbing away the stagnate air pocket
Now it works

 30

30

 31

31

Air Barrier Definitions

2012 IECC

AIR BARRIER. Material(s) assembled and joined together to provide a barrier to air leakage through the building envelope. An air barrier may be a single material or a combination of materials.

2015 IECC

AIR BARRIER. Materials assembled and joined together to provide a barrier to air leakage through the building envelope. An air barrier may be a single material or a combination of materials.

2018 IECC

AIR BARRIER. One or more materials joined together in a continuous manner to restrict or prevent the passage of air through the *building thermal envelope* and its assemblies.

2021 IECC

AIR BARRIER. One or more materials joined together in a continuous manner to restrict or prevent the passage of air through the *building thermal envelope* and its assemblies.

 32

32

C103.2 Required on Construction Documents

1. Insulation materials and their R-values.
2. Fenestration U-factors and solar heat gain coefficients (SHGCs).
3. Area-weighted U-factor and solar heat gain coefficient (SHGC) calculations.
4. Mechanical system design criteria.
5. Mechanical and service water heating systems and equipment types, sizes and efficiencies.
6. Economizer description.
7. Equipment and system controls.
8. Fan motor horsepower (hp) and controls.
9. Duct sealing, duct and pipe insulation and location.
10. Lighting fixture schedule with wattage and control narrative.
11. Location of daylight zones on floor plans.
12. Air sealing details.

2018 IECC

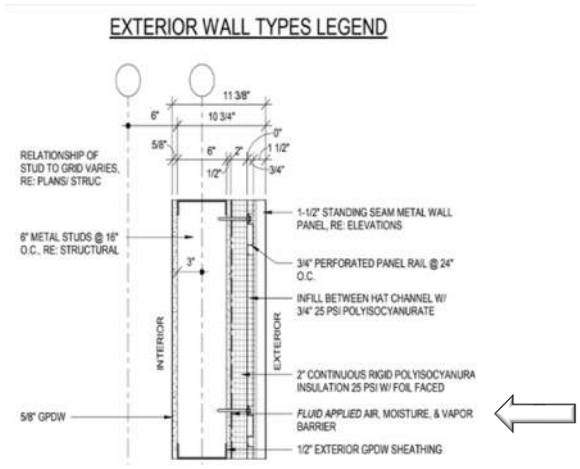
1. Energy compliance path.
2. Insulation materials and their R-values.
3. Fenestration U-factors and solar heat gain coefficients (SHGCs).
4. Area-weighted U-factor and solar heat gain coefficient (SHGC) calculations.
5. Mechanical system design criteria.
6. Mechanical and service water-heating systems and equipment types, sizes and efficiencies.
7. Economizer description.
8. Equipment and system controls.
9. Fan motor horsepower (hp) and controls.
10. Duct sealing, duct and pipe insulation and location.
11. Lighting fixture schedule with wattage and control narrative.
12. Location of daylight zones on floor plans.
13. Air barrier and air sealing details, including the location of the air barrier

2021 IECC

 33

33

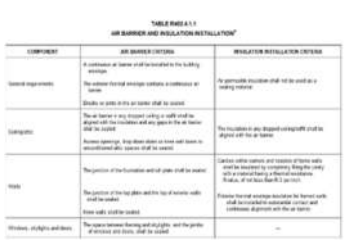
KEEP THIS IN MIND



 34

34

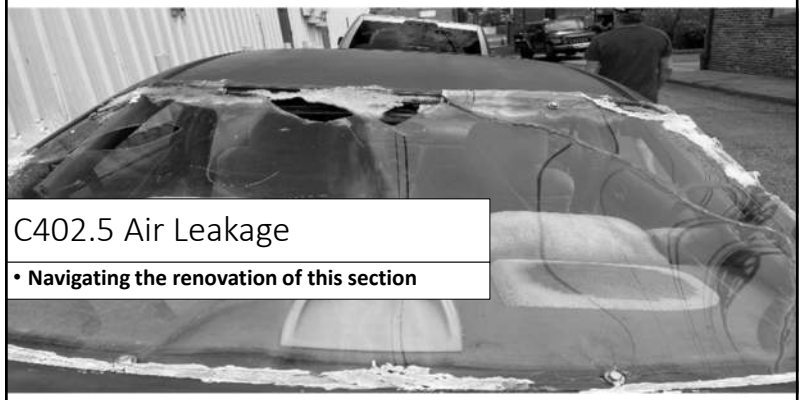
WHY DON'T WE GET A TABLE?



- C402.5 Air leakage—thermal envelope.
- C402.5.1 Air barriers.
- C402.5.1.1 Air barrier construction.
- C402.5.1.2 Air barrier compliance.
- C402.5.1.3 Materials.
- C402.5.1.4 Assemblies.
- C402.5.4 Air leakage of fenestration.
- And Other Sections

 35

35



C402.5 Air Leakage

- **Navigating the renovation of this section**

 36

36

2015/2018 IECC – Air Leakage

C402.5 Air leakage—thermal envelope

- Comply with Sections C402.5.1 through C402.5.8

OR

- Test in accordance with ASTM E 779 (75Pa) – or
- Equivalent method approved by code official
- Air leakage rate < 0.40 cfm/ft2
- Comply with Sections C402.5.5, C402.5.6, and C402.5.7

https://www.buildings.com/feature/article/10188194/air-leakage-testing-a-hot-button-or-hot-air

 37

37

2021 IECC – Air Leakage

C402.5 Air leakage—thermal envelope
- Comply with Sections C402.5.1 through C402.5.11.1

OR

- Test in accordance with Section C402.5.2 or C402.5.3
- Where testing then also comply with Sections C402.5.7, C402.5.8 and C402.5.9

Testing Approach

https://www.buildings.com/feature/article/10188194/air-leakage-testing-a-hot-button-or-hot-air

 38

38

C402.5 - Comply with Sections C402.5.1 through C402.5.11.1

2021 Approach

C402.5.1 Air barriers.
A continuous air barrier shall be provided throughout the building thermal envelope. The continuous air barriers shall be located on the inside or outside of the building thermal envelope, located within the assemblies composing the building thermal envelope, or any combination thereof. The air barrier shall comply with Sections C402.5.1.1, and C402.5.1.2.

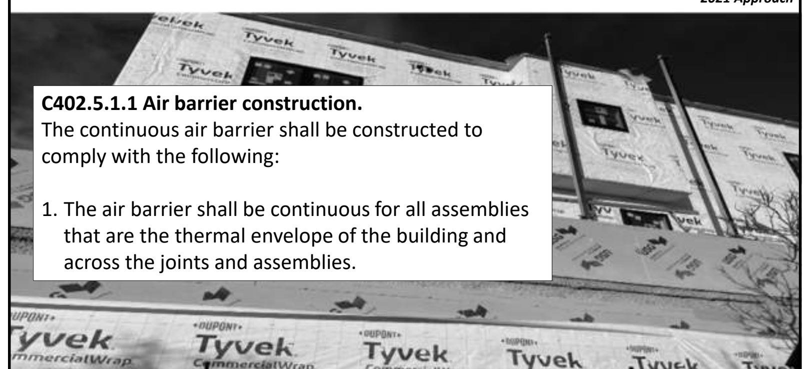
Exception: Air barriers are not required in buildings located in Climate Zone 2B.

 39

39

C402.5 - Comply with C402.5.1 through C402.5.8(2015 & 2018) or C402.5.11.1(2021)

2021 Approach



C402.5.1.1 Air barrier construction.
The continuous air barrier shall be constructed to comply with the following:

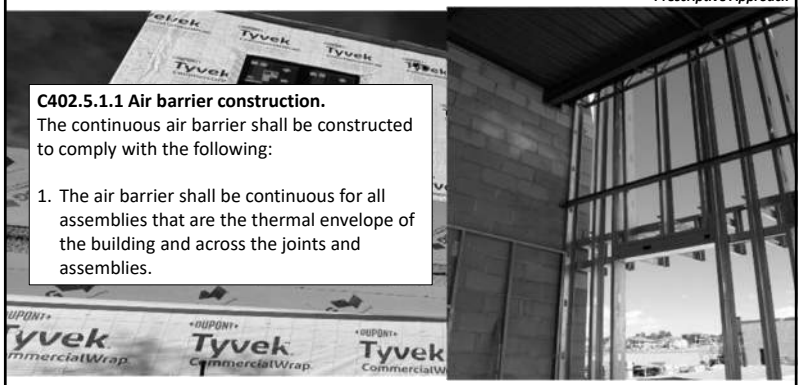
1. The air barrier shall be continuous for all assemblies that are the thermal envelope of the building and across the joints and assemblies.

 40

40

C402.5 - Comply with C402.5.1 through C402.5.8(2015 & 2018) or C402.5.11.1(2021)

Prescriptive Approach



C402.5.1.1 Air barrier construction.
The continuous air barrier shall be constructed to comply with the following:

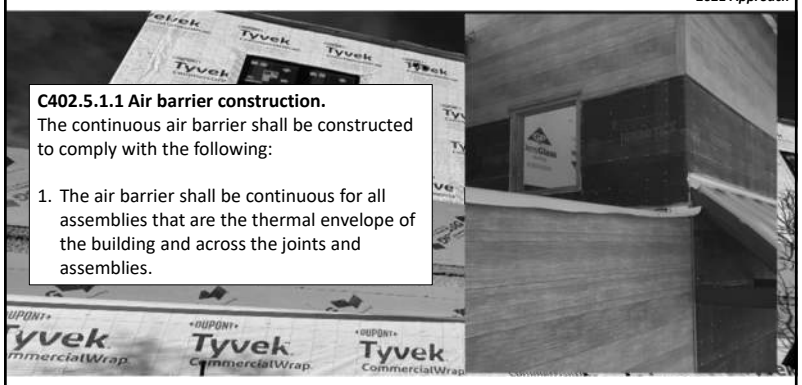
1. The air barrier shall be continuous for all assemblies that are the thermal envelope of the building and across the joints and assemblies.

 41

41

C402.5 - Comply with C402.5.1 through C402.5.8(2015 & 2018) or C402.5.11.1(2021)

2021 Approach



C402.5.1.1 Air barrier construction.
The continuous air barrier shall be constructed to comply with the following:

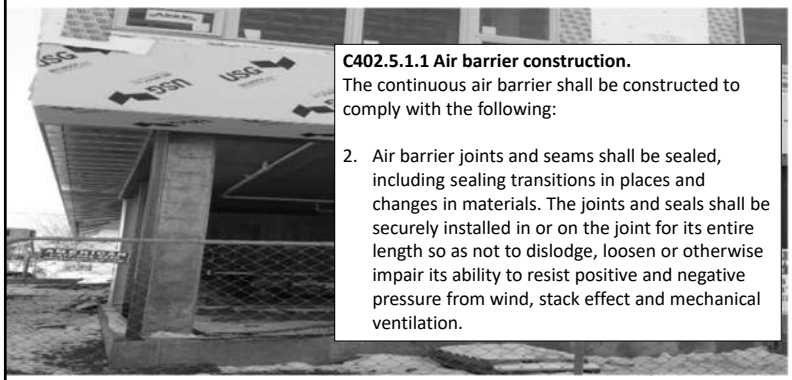
1. The air barrier shall be continuous for all assemblies that are the thermal envelope of the building and across the joints and assemblies.

 42

42

C402.5 - Comply with C402.5.1 through C402.5.8(2015 & 2018) or C402.5.11.1(2021)

2021 Approach



C402.5.1.1 Air barrier construction.
The continuous air barrier shall be constructed to comply with the following:

2. Air barrier joints and seams shall be sealed, including sealing transitions in places and changes in materials. The joints and seals shall be securely installed in or on the joint for its entire length so as not to dislodge, loosen or otherwise impair its ability to resist positive and negative pressure from wind, stack effect and mechanical ventilation.

 43

43

C402.5 - Comply with C402.5.1 through C402.5.8(2015 & 2018) or C402.5.11.1(2021)

2021 Approach

 44

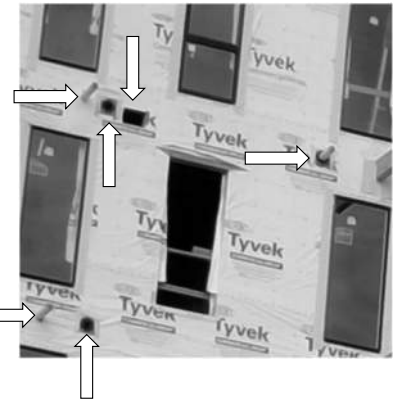
44

C402.5 - Comply with C402.5.1 through C402.5.8(2015 & 2018) or C402.5.11.1(2021)

2021 Approach

C402.5.1.1 Air barrier construction.
The continuous air barrier shall be constructed to comply with the following

3. Penetrations of the air barrier shall be caulked, gasketed or otherwise sealed in a manner compatible with the construction materials and location. Sealing shall allow for expansion, contraction and mechanical vibration. Joints and seams associated with penetrations shall be sealed in the same manner or taped. Sealing materials shall be securely installed around the penetration so as not to dislodge, loosen or otherwise impair the penetrations' ability to resist positive and negative pressure from wind, stack effect and mechanical ventilation.



 45

45

C402.5 - Comply with C402.5.1 through C402.5.8(2015 & 2018) or C402.5.11.1(2021)

2021 Approach

 46

46

C402.5 - Comply with C402.5.1 through C402.5.8(2015 & 2018) or C402.5.11.1(2021)

2021 Approach

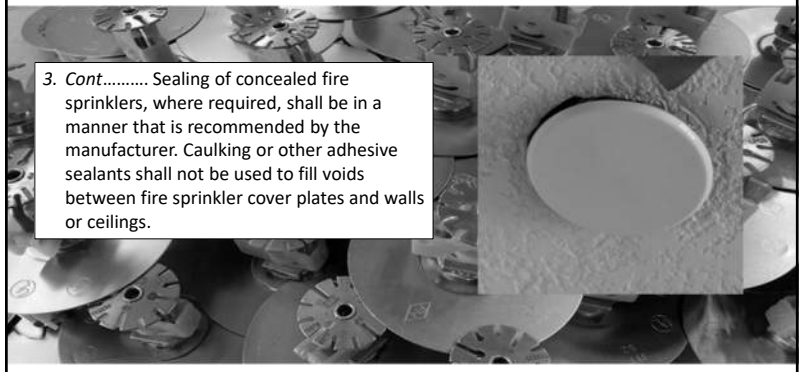
 47

47

C402.5 - Comply with C402.5.1 through C402.5.8(2015 & 2018) or C402.5.11.1(2021)

2021 Approach

3. *Cont*……. Sealing of concealed fire sprinklers, where required, shall be in a manner that is recommended by the manufacturer. Caulking or other adhesive sealants shall not be used to fill voids between fire sprinkler cover plates and walls or ceilings.

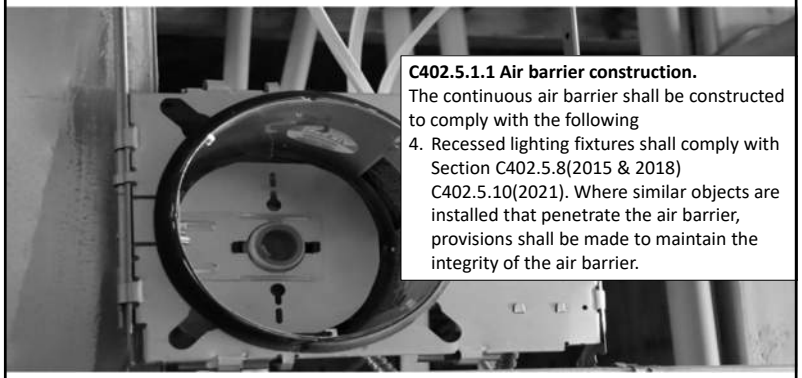


 48

48

C402.5 - Comply with C402.5.1 through C402.5.8(2015 & 2018) or C402.5.11.1(2021)

2021 Approach



C402.5.1.1 Air barrier construction.
The continuous air barrier shall be constructed to comply with the following

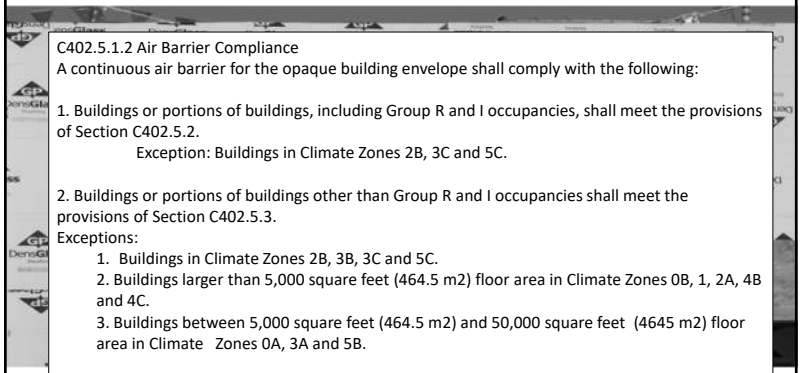
4. Recessed lighting fixtures shall comply with Section C402.5.8(2015 & 2018) C402.5.10(2021). Where similar objects are installed that penetrate the air barrier, provisions shall be made to maintain the integrity of the air barrier.

 49

49

C402.5 - Comply with C402.5.1 through C402.5.8(2015 & 2018) or C402.5.11.1(2021)

2021 Approach



C402.5.1.2 Air Barrier Compliance
A continuous air barrier for the opaque building envelope shall comply with the following:

1. Buildings or portions of buildings, including Group R and I occupancies, shall meet the provisions of Section C402.5.2.
   Exception: Buildings in Climate Zones 2B, 3C and 5C.

2. Buildings or portions of buildings other than Group R and I occupancies shall meet the provisions of Section C402.5.3.
Exceptions:
   1. Buildings in Climate Zones 2B, 3B, 3C and 5C.
   2. Buildings larger than 5,000 square feet (464.5 m2) floor area in Climate Zones 0B, 1, 2A, 4B and 4C.
   3. Buildings between 5,000 square feet (464.5 m2) and 50,000 square feet (4645 m2) floor area in Climate Zones 0A, 3A and 5B.

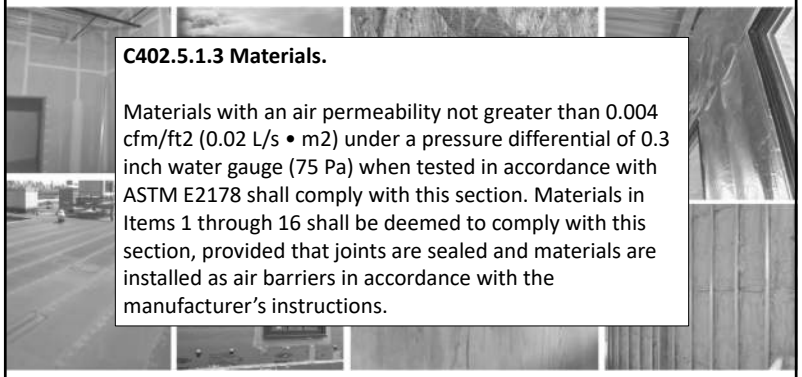
3. Buildings or portions of buildings that do not complete air barrier testing shall meet the provisions of Section C402.5.1.3 or C402.5.1.4 in addition to Section C402.5.1.5.

 50

50

C402.5 - Comply with C402.5.1 through C402.5.8(2015 & 2018) or C402.5.11.1(2021)

2021 Approach



C402.5.1.3 Materials.

Materials with an air permeability not greater than 0.004 cfm/ft2 (0.02 L/s • m2) under a pressure differential of 0.3 inch water gauge (75 Pa) when tested in accordance with ASTM E2178 shall comply with this section. Materials in Items 1 through 16 shall be deemed to comply with this section, provided that joints are sealed and materials are installed as air barriers in accordance with the manufacturer's instructions.

 51

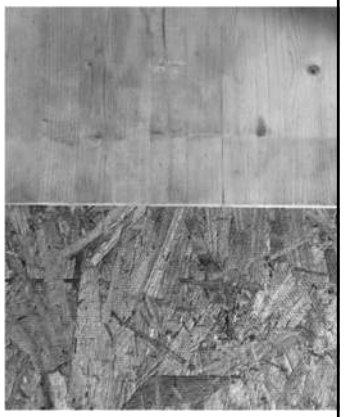
51

C402.5 - Comply with C402.5.1 through C402.5.8(2015 & 2018) or C402.5.11.1(2021)

C402.5.1.3 Materials.

1. Plywood with a thickness of not less than 3/8 inch

2. Oriented strand board having a thickness of not less than 3/8 inch



 52

52

C402.5 - Comply with C402.5.1 through C402.5.8(2015 & 2018) or C402.5.11.1(2021)

C402.5.1.3 Materials.

1. Plywood with a thickness of not less than 3/8 inch
2. Oriented strand board having a thickness of not less than 3/8 inch
3. Extruded polystyrene insulation board having a thickness of not less than 1/2 inch

 53

53

C402.5 - Comply with C402.5.1 through C402.5.8(2015 & 2018) or C402.5.11.1(2021)

C402.5.1.3 Materials.

1. Plywood with a thickness of not less than 3/8 inch
2. Oriented strand board having a thickness of not less than 3/8 inch
3. Extruded polystyrene insulation board having a thickness of not less than 1/2 inch
4. Foil-back polyisocyanurate insulation board having a thickness of not less than 1/2 inch

 54

54

C402.5.1.3 Materials.

1. Plywood with a thickness of not less than 3/8 inch
2. Oriented strand board having a thickness of not less than 3/8 inch
3. Extruded polystyrene insulation board having a thickness of not less than 1/2 inch
4. Foil-back polyisocyanurate insulation board having a thickness of not less than 1/2 inch
5. Closed-cell spray foam having a minimum density of 1.5 pcf (2.4 kg/m3) and having a thickness of not less than 1 1/2 inches

 55

55

C402.5.1.3 Materials.

1. Plywood with a thickness of not less than 3/8 inch
2. Oriented strand board having a thickness of not less than 3/8 inch
3. Extruded polystyrene insulation board having a thickness of not less than 1/2 inch
4. Foil-back polyisocyanurate insulation board having a thickness of not less than 1/2 inch
5. Closed-cell spray foam having a minimum density of 1.5 pcf (2.4 kg/m3) and having a thickness of not less than 11/2 inches
6. Open-cell spray foam with a density between 0.4 and 1.5 pcf (0.6 and 2.4 kg/m3) and having a thickness of not less than 4.5 inches

 56

56

C402.5.1.3 Materials.

1. Plywood with a thickness of not less than 3/8 inch
2. Oriented strand board having a thickness of not less than 3/8 inch
3. Extruded polystyrene insulation board having a thickness of not less than 1/2 inch
4. Foil-back polyisocyanurate insulation board having a thickness of not less than 1/2 inch
5. Closed-cell spray foam having a minimum density of 1.5 pcf (2.4 kg/m3) and having a thickness of not less than 11/2 inches
6. Open-cell spray foam with a density between 0.4 and 1.5 pcf (0.6 and 2.4 kg/m3) and having a thickness of not less than 4.5 inches
7. Exterior or interior gypsum board having a thickness of not less than 1/2 inch
8. Cement board having a thickness of not less than 1/2 inch

 57

57

C402.5.1.3 Materials.

1. Plywood with a thickness of not less than 3/8 inch
2. Oriented strand board having a thickness of not less than 3/8 inch
3. Extruded polystyrene insulation board having a thickness of not less than 1/2 inch
4. Foil-back polyisocyanurate insulation board having a thickness of not less than 1/2 inch
5. Closed-cell spray foam having a minimum density of 1.5 pcf (2.4 kg/m3) and having a thickness of not less than 11/2 inches
6. Open-cell spray foam with a density between 0.4 and 1.5 pcf (0.6 and 2.4 kg/m3) and having a thickness of not less than 4.5 inches
7. Exterior or interior gypsum board having a thickness of not less than 1/2 inch
8. Cement board having a thickness of not less than 1/2 inch
9. Built-up roofing membrane
10. Modified bituminous roof membrane
11. Fully adhered single-ply roof membrane(2015/2018)
11. Single-ply roof membrane(2021)

 58

58

C402.5.1.3 Materials.

1. Plywood with a thickness of not less than 3/8 inch
2. Oriented strand board having a thickness of not less than 3/8 inch
3. Extruded polystyrene insulation board having a thickness of not less than 1/2 inch
4. Foil-back polyisocyanurate insulation board having a thickness of not less than 1/2 inch
5. Closed-cell spray foam having a minimum density of 1.5 pcf (2.4 kg/m3) and having a thickness of not less than 11/2 inches
6. Open-cell spray foam with a density between 0.4 and 1.5 pcf (0.6 and 2.4 kg/m3) and having a thickness of not less than 4.5 inches
7. Exterior or interior gypsum board having a thickness of not less than 1/2 inch
8. Cement board having a thickness of not less than 1/2 inch
9. Built-up roofing membrane
10. Modified bituminous roof membrane
11. Single-ply membrane
12. A Portland cement/sand parge, or gypsum plaster having a thickness of not less than 5/8 inch

 59

59

C402.5.1.3 Materials.

1. Plywood with a thickness of not less than 3/8 inch
2. Oriented strand board having a thickness of not less than 3/8 inch
3. Extruded polystyrene insulation board having a thickness of not less than 1/2 inch
4. Foil-back polyisocyanurate insulation board having a thickness of not less than 1/2 inch
5. Closed-cell spray foam having a minimum density of 1.5 pcf (2.4 kg/m3) and having a thickness of not less than 11/2 inches
6. Open-cell spray foam with a density between 0.4 and 1.5 pcf (0.6 and 2.4 kg/m3) and having a thickness of not less than 4.5 inches
7. Exterior or interior gypsum board having a thickness of not less than 1/2 inch
8. Cement board having a thickness of not less than 1/2 inch
9. Built-up roofing membrane
10. Modified bituminous roof membrane
11. Fully adhered single-ply roof membrane or Single-ply membrane
12. A Portland cement/sand parge, or gypsum plaster having a thickness of not less than 5/8 inch
13. Cast-in-place and precast concrete

 60

60

C402.5.1.3 Materials.

1. Plywood with a thickness of not less than 3/8 inch
2. Oriented strand board having a thickness of not less than 3/8 inch
3. Extruded polystyrene insulation board having a thickness of not less than 1/2 inch
4. Foil-back polyisocyanurate insulation board having a thickness of not less than 1/2 inch
5. Closed-cell spray foam having a minimum density of 1.5 pcf (2.4 kg/m3) and having a thickness of not less than 11/2 inches
6. Open-cell spray foam with a density between 0.4 and 1.5 pcf (0.6 and 2.4 kg/m3) and having a thickness of not less than 4.5 inches
7. Exterior or interior gypsum board having a thickness of not less than 1/2 inch
8. Cement board having a thickness of not less than 1/2 inch
9. Built-up roofing membrane
10. Modified bituminous roof membrane
11. Single-ply membrane
12. A Portland cement/sand parge, or gypsum plaster having a thickness of not less than 5/8 inch
13. Cast-in-place and precast concrete

14.Fully grouted concrete block masonry

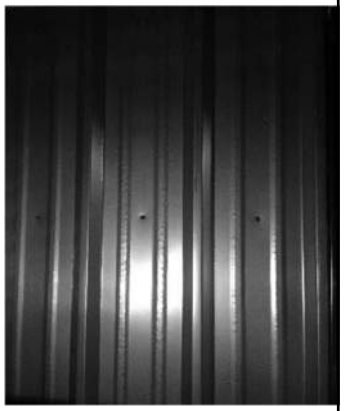
 61

61

C402.5.1.3 Materials.

1. Plywood with a thickness of not less than 3/8 inch
2. Oriented strand board having a thickness of not less than 3/8 inch
3. Extruded polystyrene insulation board having a thickness of not less than 1/2 inch
4. Foil-back polyisocyanurate insulation board having a thickness of not less than 1/2 inch
5. Closed-cell spray foam having a minimum density of 1.5 pcf (2.4 kg/m3) and having a thickness of not less than 11/2 inches
6. Open-cell spray foam with a density between 0.4 and 1.5 pcf (0.6 and 2.4 kg/m3) and having a thickness of not less than 4.5 inches
7. Exterior or interior gypsum board having a thickness of not less than 1/2 inch
8. Cement board having a thickness of not less than 1/2 inch
9. Built-up roofing membrane
10. Modified bituminous roof membrane
11. Single-ply roof membrane
12. A Portland cement/sand parge, or gypsum plaster having a thickness of not less than 5/8 inch
13. Cast-in-place and precast concrete
14. Fully grouted concrete block masonry

15.Sheet steel or aluminum



 62

62

C402.5.1.3 Materials.

1. Plywood with a thickness of not less than 3/8 inch
2. Oriented strand board having a thickness of not less than 3/8 inch
3. Extruded polystyrene insulation board having a thickness of not less than 1/2 inch
4. Foil-back polyisocyanurate insulation board having a thickness of not less than 1/2 inch
5. Closed-cell spray foam having a minimum density of 1.5 pcf (2.4 kg/m3) and having a thickness of not less than 11/2 inches
6. Open-cell spray foam with a density between 0.4 and 1.5 pcf (0.6 and 2.4 kg/m3) and having a thickness of not less than 4.5 inches
7. Exterior or interior gypsum board having a thickness of not less than 1/2 inch
8. Cement board having a thickness of not less than 1/2 inch
9. Built-up roofing membrane
10. Modified bituminous roof membrane
11. Single-ply roof membrane
12. A Portland cement/sand parge, or gypsum plaster having a thickness of not less than 5/8 inch
13. Cast-in-place and precast concrete
14. Fully grouted concrete block masonry
15. Sheet steel or aluminum

16.Solid or hollow masonry constructed of clay or shale masonry units

 63

63

C402.5 - Comply with C402.5.1 through C402.5.8(2015 & 2018) or C402.5.11.1(2021)

C402.5.1.4 Assemblies.

Assemblies of materials and components with an average air leakage not greater than 0.04 cfm/ under a pressure differential of 0.3 inch of water gauge (w.g.)(75 Pa) when tested in accordance with ASTM E2357, ASTM E1677, ASTM D8052 or ASTM E283 shall comply with this section. Assemblies listed in Items 1 through 3 shall be deemed to comply, provided that joints are sealed and the requirements of Section C402.5.1.1 are met.

1. Concrete masonry walls coated with either one application of block filler or two applications of a paint or sealer coating.
2. Masonry walls constructed of clay or shale masonry units with a nominal width of 4 inches or more.
3. A Portland cement/sand parge, stucco or plaster not less than 1/2 inch in thickness.

 64

64

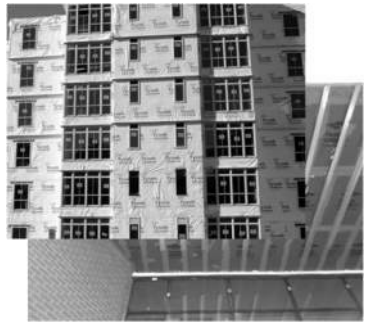
C402.5 - Comply with C402.5.1 through C402.5.8(2015 & 2018) or C402.5.11.1(2021)

WHAT MATERIALS ARE **NOT** LISTED?

 65

65

AIR BARRIER. One or more materials joined together in a continuous manner to restrict or prevent the passage of air through the building thermal envelope and its assemblies



WATER-RESISTIVE BARRIER.
A material behind an exterior wall covering that is intended to resist liquid water that has penetrated behind the exterior covering from further intruding into the exterior wall assembly.

 66

66

When installed as they were tested

 67

67

Water-Resistive Barrier (WRB) Code Requirements

The 2015 International Residential Code (Section R703.1.1 Water Resistance) requires that "the exterior wall envelope shall be designed and constructed in a manner that prevents the accumulation of water within the wall assembly by providing a water-resistant barrier behind the exterior veneer as required by Section R703.2 and a means of draining to the exterior water that enters the assembly." Section R703.2 (Water-resistive barrier) states that "one layer of No. 15 asphalt felt, free from holes and breaks, complying with ASTM D 226 for Type 1 felt or other approved water-resistive barrier shall be applied over studs or sheathing of all exterior walls. Such felt or material shall be applied horizontally, with the upper layer lapped over the lower layer not less than 2 inches (51 mm). Where joints occur, felt shall be lapped not less than 6 inches (152 mm). The felt or other approved material shall be continuous to the top of walls and terminated at penetrations and building appendages in a manner to meet the requirements of the exterior wall envelope as described in Section R703.1."

The 2015 International Building Code (Section 1403.2 Weather Protection) requires that "exterior walls shall provide the building with a weather resistant exterior wall envelope. The exterior wall envelope shall include flashing, as described in Section 1405.4. The exterior wall envelope shall be designed and constructed in such a manner as to prevent the accumulation of water within the wall assembly by providing a water-resistive barrier behind the exterior veneer, as described in Section 1404.2, and a means for draining water that enters the assembly to the exterior. Section 1404.2 (Water-resistive barrier) states that "not fewer than one layer of No. 15 asphalt felt, complying with ASTM D 226 for Type 1 felt or other approved materials, shall be attached to the studs or sheathing, with flashing as described in Section 1405.4, in such a manner as to provide a continuous water-resistive barrier behind the exterior veneer.

- DuPont™ Tyvek® StuccoWrap®
- DuPont™ Tyvek® DrainWrap™
- DuPont™ Tyvek® CommercialWrap®
- DuPont™ Tyvek® CommercialWrap® D
- ICC-ESR-1993: DuPont™ Tyvek® ThermalWrap™ LE

And Industry Standard ASTM E 2556 Type II Standard Specification for Vapor Permeable Flexible Sheet Water-Resistive Barriers Intended for Mechanical Attachment

Air leakage control and air barriers are required in the IECC-2015 Sections R402.4 and C402.4. Specifically, Section C402.5 identifies three compliance options for air barriers. DuPont™ Tyvek® WRBs comply with the option detailed in Section C402.5.1.2.1: "C402.5.1.2.1 Materials. Materials with an air permeability no greater than 0.004 cfm/ft² (0.02 L/s x m²) under a pressure differential of 0.3 inches water gauge (75 Pa) when tested in accordance with ASTM E 2178 shall comply with this section." Tyvek® WRBs have been tested in accordance with ASTM E2178 and have air permeability less than 0.02 L/s x m².

DuPont™ Tyvek® WRBs have been tested to the following standards:

- ASTM E 1677 Standard Specification for an Air Retarder (AR) Material or System for Low-Rise Framed Building Walls
- ASTM E 2178 Standard Test Method for Air Permeance of Building Materials
- ASTM E96-05 Water Vapor Transmission
- ATTCC 127 Water Penetration Resistance
- ASTM E 84 Standard Test Method for Surface Burning Characteristics of Building Materials

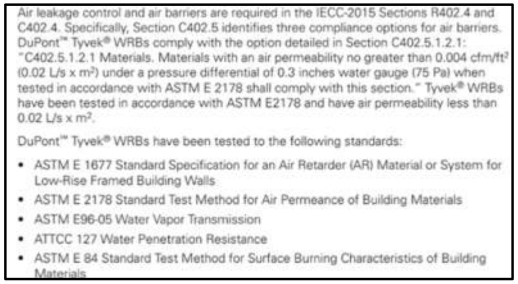
The application of DuPont™ Tyvek® WRBs is governed by the code adopted and enforced by the local jurisdiction. Consult your jurisdiction to assure compliance with the local building code.

When installed as they were tested

when tested in accordance with ASTM E2357, ASTM E1677, ASTM D8052 or ASTM E283

 68

68



Air leakage control and air barriers are required in the IECC-2015 Sections R402.4 and C402.4. Specifically, Section C402.5 identifies three compliance options for air barriers. DuPont™ Tyvek® WRBs comply with the option detailed in Section C402.5.1.2.1: "C402.5.1.2.1 Materials. Materials with an air permeability no greater than 0.004 cfm/ft² (0.02 L/s x m²) under a pressure differential of 0.3 inches water gauge (75 Pa) when tested in accordance with ASTM E 2178 shall comply with this section." Tyvek® WRBs have been tested in accordance with ASTM E2178 and have air permeability less than 0.02 L/s x m².

DuPont™ Tyvek® WRBs have been tested to the following standards:

- ASTM E 1677 Standard Specification for an Air Retarder (AR) Material or System for Low-Rise Framed Building Walls
- ASTM E 2178 Standard Test Method for Air Permeance of Building Materials
- ASTM E96-05 Water Vapor Transmission
- ATTCC 127 Water Penetration Resistance
- ASTM E 84 Standard Test Method for Surface Burning Characteristics of Building Materials

When installed as they were tested

when tested in accordance with ASTM E2357, ASTM E1677, ASTM D8052 or ASTM E283

© 2023 Shums Coda Associates 69

69

STEP 7 (FOR AIR BARRIER INSTALLATIONS)

When installing as an air barrier, the horizontal seams must be taped. The use of 3" **Tyvek® Tape** is required for both vertical and horizontal seams of **Tyvek® StuccoWrap®** and **Tyvek® DrainWrap™** for air barrier installations.

STEP 8 (FOR AIR BARRIER INSTALLATIONS)

Taping or sealing all terminations of **Tyvek® WRBs** (including, but not limited to, roof-wall and bottom of the wall interfaces) using **Tyvek® Tape**, **DuPont™ Residential Sealant** (or recommended sealant), **DuPont™ StraightFlash™**, or **DuPont™ Flashing Tape** is required when installing as an air barrier.*

When installed as they were tested

© 2023 Shums Coda Associates 70

70

AIR BARRIER. One or more materials joined together in a continuous
to restrict or prevent the
of air through the building
envelope and its assemblies

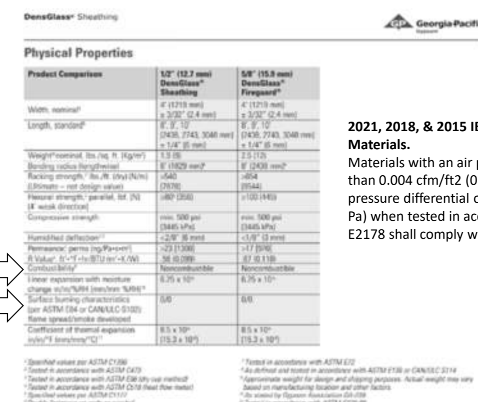
[BF]FIRE RESISTANCE. That pro
or their assemblies that preve
passage of excessive heat, ho
under conditions c

© 2023 Shums Coda Associates 71

71

C402.5 - Comply with C402.5.1 through C402.5.8(2015 & 2018) or C402.5.11.1(2021)

2021 Approach

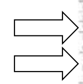


DensGlass® Sheathing

Georgia-Pacific

Physical Properties

Product Comparison	1/2" (12.7 mm) DensGlass® Sheathing	5/8" (15.9 mm) DensGlass® Fireguard®
Width, nominal	4' (1219 mm) ± 3/32" (2.4 mm)	4' (1219 mm) ± 3/32" (2.4 mm)
Length, standard	8', 9', 10' (2438, 2743, 3048 mm) ± 1/4" (6 mm)	8', 9', 10' (2438, 2743, 3048 mm) ± 1/4" (6 mm)
Weight nominal, lbs./sq. ft. (Kg/m²)	1.3 (6)	2.5 (12)
Bending radius (lengthwise)	6' (1829 mm)	8' (2438 mm)
Racking strength, lbs./ft. (dry) (N/m) (Ultimate – not design value)	>540 (7878)	>654 (9544)
Flexural strength, parallel, lbf. (N) (4' weak direction)	≥80 (356)	≥100 (445)
Compressive strength	min. 500 psi (3445 kPa)	min. 500 psi (3445 kPa)
Humidified deflection	<2/8" (6 mm)	<1/8" (3 mm)
Permeance, perms (ng/Pa•s•m²)	>23 (1308)	>17 (970)
R Value, ft²•°F•hr/BTU (m²•K/W)	.56 (0.099)	.67 (0.118)
Combustibility	Noncombustible	Noncombustible
Linear expansion with moisture change in/in/%RH (mm/mm %RH)	6.25 x 10⁻⁶	6.25 x 10⁻⁶
Surface burning characteristics (per ASTM E84 or CAN/ULC-S102) flame spread/smoke developed	0/0	0/0
Coefficient of thermal expansion in/in/°F (mm/mm/°C)	8.5 x 10⁻⁶ (15.3 x 10⁻⁶)	8.5 x 10⁻⁶ (15.3 x 10⁻⁶)



2021, 2018, & 2015 IECC
Materials.
Materials with an air permeability not greater than 0.004 cfm/ft2 (0.02 L/s × m2) under a pressure differential of 0.3 inch water gauge (75 Pa) when tested in accordance with ASTM E2178 shall comply with this section.

© 2023 Shums Coda Associates 72

72

C402.5 - Comply with C402.5.1 through C402.5.8(2015 & 2018) or C402.5.11.1(2021)

2021 Approach

Georgia-Pacific

DensGlass® Sheathing

Water- and Air-Resistive Barriers

Evolving codes, standards and programs are requiring the use of water and air resistive barriers. In most cases, these barriers are applied over the exterior sheathing. DensGlass® Sheathing has been widely accepted as a preferred substrate for all recognized types of water and air resistive barriers.

- Self-adhered sheet materials
- Fluid applied membranes
- Spray polyurethane foam (medium density closed cell)
- Mechanically attached flexible sheet (includes #15 asphalt felt and synthetic wraps)
- Boardstock air barrier – rigid foam core

For a list of air barrier materials, accessories and components, see the Air Barrier Association of America (ABAA) website (www.airbarrier.org).

Where joint protection is required or desired, two methods may be used: **Method 1)** Apply minimum 3/8" (9 mm) bead of sealant to joints and trowel to provide a layer approximately 2" (51 mm) wide by 1/16" (2 mm) thick spanning the joint. Use backer rod for openings larger than 1/8" (3 mm). **Method 2)** Apply glass mesh joint tape to all joints, overlapping at intersections by the width of the tape. Apply approximately 3/8" (9 mm) bead of caulk along the joint. Embed the caulk into the entire surface of the tape with a trowel. Use backer rod for openings larger than 1/8" (3 mm). Follow manufacturer's installation recommendations for use with DensGlass Sheathing, and design authority specifications.

Note: Consult with local building code, design professional, owner or cladding manufacturer for water-resistive barrier requirements and compatibility with the wall cladding.

Protection of Penetrations

All penetrations should be protected to prevent air and water infiltration. Follow building code, door/window manufacturer or design authority's recommendations for flashing around openings, abutments to dissimilar materials and wall terminations.

Air Barrier Compliance

For the International Energy Conservation Code® (IECC), gypsum sheathing such as DensGlass Sheathing complies with the prescriptive code language for use as a continuous air barrier when the joints and openings are properly sealed.

C402.5.1.3 Materials. P

Materials with an air permeability not greater than 0.004 cfm/ft² (0.02 L/s × m²) under a pressure differential of 0.3 inch water gauge (75 Pa) when tested in accordance with ASTM E2178 shall comply with this section. Materials in Items 1 through 16 shall be deemed to comply with this section, provided that joints are sealed and materials are installed as air barriers in accordance with the manufacturer's instructions.

7. Exterior or interior gypsum board having a thickness of not less than $^1/_2$ inch (12.7 mm).

73

73

C402.5 - Comply with C402.5.1 through C402.5.8(2015 & 2018) or C402.5.11.1(2021)

2021 Approach

C402.5.1.5 Building envelope performance verification.

The installation of the continuous air barrier shall be verified by the *code official*, a *registered design professional* or *approved* agency in accordance with the following:

1. A review of the construction documents and other supporting data shall be conducted to assess compliance with the requirements in Section C402.5.1.
2. Inspection of continuous air barrier components and assemblies shall be conducted during construction while the air barrier is still accessible for inspection and repair to verify compliance with the requirements of Sections C402.5.1.3 and C402.5.1.4.
3. A final commissioning report shall be provided for inspections completed by the *registered design professional* or *approved* agency. The commissioning report shall be provided to the building owner or owner's authorized agent and the *code official*. The report shall identify deficiencies found during the review of the construction documents and inspection and details of corrective measures taken.

74

74

C402.5 - Comply with C402.5.1 through C402.5.8(2015 & 2018) or C402.5.11.1(2021)

2021 Approach

C402.5.1.5 Building envelope performance verification.

The installation of the continuous air barrier shall be verified by the *code official*, a *registered design professional* or *approved* agency in accordance with the following:

75

75

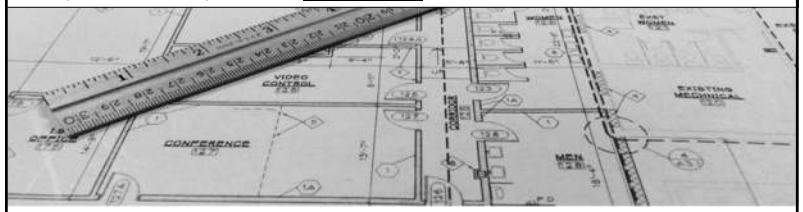
C402.5 - Comply with C402.5.1 through C402.5.8(2015 & 2018) or C402.5.11.1(2021)

2021 Approach

C402.5.1.5 Building envelope performance verification

The installation of the continuous air barrier shall be verified by the *code official*, a *registered design professional* or *approved* agency in accordance with the following:

1. A review of the construction documents and other supporting data shall be conducted to assess compliance with the requirements in Section C402.5.1.



76

76

C402.5 - Comply with C402.5.1 through C402.5.8(2015 & 2018) or C402.5.11.1(2021)

2021 Approach

C402.5.1.5 Building envelope performance verification

2. Inspection of continuous air barrier components and assemblies shall be conducted during construction while the air barrier is still accessible for inspection and repair to verify compliance with the requirements of Sections C402.5.1.3 and C402.5.1.4.

Materials Assemblies

 77

77

C402.5 - Comply with C402.5.1 through C402.5.8(2015 & 2018) or C402.5.11.1(2021)

2021 Approach

C402.5.1.5 Building envelope performance verification.

3. A final commissioning report shall be provided for inspections completed by the *registered design professional* or *approved* agency. The commissioning report shall be provided to the building owner or owner's authorized agent and the *code official*. The report shall identify deficiencies found during the review of the construction documents and inspection and details of corrective measures taken.

 78

78

C402.5 - Comply with C402.5.1 through C402.5.8(2015 & 2018) or C402.5.11.1(2021)

2021 Approach

C402.5.1.5 Building envelope performance verification.

The installation of the continuous air barrier shall be verified by the *code official*, a *registered design professional* or *approved* agency in accordance with the following:

1. A review of the construction documents and other supporting data shall be conducted to assess compliance with the requirements in Section C402.5.1.
2. Inspection of continuous air barrier components and assemblies shall be conducted during construction while the air barrier is still accessible for inspection and repair to verify compliance with the requirements of Sections C402.5.1.3 and C402.5.1.4.
3. A final commissioning report shall be provided for inspections completed by the *registered design professional* or *approved* agency. The commissioning report shall be provided to the building owner or owner's authorized agent and the *code official*. The report shall identify deficiencies found during the review of the construction documents and inspection and details of corrective measures taken.

 79

79

C402.5 - Comply with C402.5.1 through C402.5.8(2015 & 2018) or C402.5.11.1(2021)

2021 Approach

C402.5.1.2 Air Barrier Compliance
A continuous air barrier for the opaque building envelope shall comply with the following:

1. Buildings or portions of buildings, including Group R and I occupancies, shall meet the provisions of Section C402.5.2.
Exception: Buildings in Climate Zones 2B, 3C and 5C.

 80

80

C402.5 - Comply with C402.5.1 through C402.5.8(2015 & 2018) or C402.5.11.1(2021)

2021 Approach

C402.5.2 Dwelling and sleeping unit enclosure testing.

The *building thermal envelope* shall be tested in accordance with ASTM E779, ANSI/RESNET/ICC 380, ASTM E1827 or an equivalent method approved by the *code official*. The measured air leakage shall not exceed 0.30 cfm/ft^2 of the testing unit enclosure area at a pressure differential of 0.2 inch water gauge (50 Pa). Where multiple dwelling units or sleeping units or other occupiable conditioned spaces are contained within one *building thermal envelope*, each unit shall be considered an individual testing unit, and the building air leakage shall be the weighted average of all testing unit results, weighted by each testing unit's enclosure area. Units shall be tested separately with an unguarded blower door test as follows:

1. Where buildings have fewer than eight testing units, each testing unit shall be tested.
2. For buildings with eight or more testing units, the greater of seven units or 20 percent of the testing units in the building shall be tested, including a top floor unit, a ground floor unit and a unit with the largest testing unit enclosure area. For each tested unit that exceeds the maximum air leakage rate, an additional two units shall be tested, including a mixture of testing unit types and locations.

 81

81

C402.5 - Comply with C402.5.1 through C402.5.8(2015 & 2018) or C402.5.11.1(2021)

2021 Approach

C402.5.2 Dwelling and sleeping unit enclosure testing.

The *building thermal envelope* shall be tested in accordance with ASTM E779, ANSI/RESNET/ICC 380, ASTM E1827 or an equivalent method approved by the *code official*. The measured air leakage shall not exceed 0.30 cfm/ft^2 (1.5 L/s m^2) of the testing unit enclosure area at a pressure differential of 0.2 inch water gauge (50 Pa).

R402.4.1.2 Testing (RESIDENTIAL AIR TESTNG REQUIREMENTS- not the full sections)

Exception: When testing individual *dwelling units*, an air leakage rate not exceeding 0.30 cubic feet per minute per square foot [0.008 m^3/(s × m^2)] of the dwelling unit enclosure area, tested in accordance with ANSI/RESNET/ICC 380, ASTM E779 or ASTM E1827 and reported at a pressure of 0.2 inch w.g. (50 Pa), shall be permitted in all climate zones for:

1.Attached single and multiple-family building *dwelling units*.

2.Buildings or *dwelling units* that are 1,500 square feet (139.4 m^2) or smaller.

.30 cfm/ft2 is equal to about 5 ach

 82

82

C402.5 - Comply with C402.5.1 through C402.5.8(2015 & 2018) or C402.5.11.1(2021)

2021 Approach

C402.5.2 Dwelling and sleeping unit enclosure testing.

The *building thermal envelope* shall be tested in accordance with ASTM E779, ANSI/RESNET/ICC 380, ASTM E1827 or an equivalent method approved by the *code official*. The measured air leakage shall not exceed 0.30 cfm/ft^2 (1.5 L/s m^2) of the testing unit enclosure area at a pressure differential of 0.2 inch water gauge (50 Pa). Where multiple dwelling units or sleeping units or other occupiable conditioned spaces are contained within one *building thermal envelope*, each unit shall be considered an individual testing unit, and the building air leakage shall be the weighted average of all testing unit results, weighted by each testing unit's enclosure area. Units shall be tested separately with an unguarded blower door test as follows:

 83

83

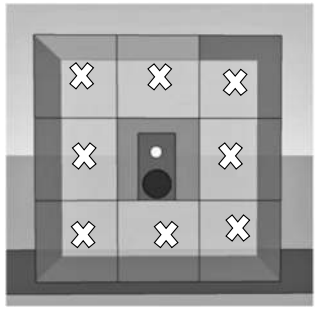
C402.5 - Comply with C402.5.1 through C402.5.8(2015 & 2018) or C402.5.11.1(2021)

2021 Approach

Unguarded Blower Door Test

Single point measures dwelling unit air leakage using single blower door fan.

One at a time



https://www.greenbuildingadvisor.com/article/testing-air-leakage-in-multifamily-buildings

 84

84

C402.5 - Comply with C402.5.1 through C402.5.8(2015 & 2018) or C402.5.11.1(2021)

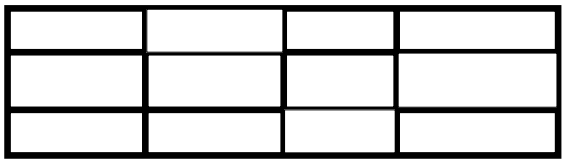
2021 Approach

C402.5.2 Dwelling and sleeping unit enclosure testing.

Units shall be tested separately with an unguarded blower door test as follows:

1. Where buildings have fewer than eight testing units, each testing unit shall be tested.
2. For buildings with eight or more testing units, the greater of seven units or 20 percent of the testing units in the building shall be tested, including a top floor unit, a ground floor unit and a unit with the largest testing unit enclosure area. For each tested unit that exceeds the maximum air leakage rate, an additional two units shall be tested, including a mixture of testing unit types and locations.

7 units – or 20%



 85

85

C402.5 - Comply with C402.5.1 through C402.5.8(2015 & 2018) or C402.5.11.1(2021)

2021 Approach

C402.5.3 Building thermal envelope testing.

The *building thermal envelope* shall be tested in accordance with ASTM E779, ANSI/RESNET/ICC 380, ASTM E3158 or ASTM E1827 or an equivalent method approved by the code official. The measured air leakage shall not exceed 0.40 cfm/ft^2 (2.0 L/s × m^2) of the *building thermal envelope* area at a pressure differential of 0.3 inch water gauge (75 Pa). Alternatively, portions of the building shall be tested and the measured air leakages shall be area weighted by the surface areas of the building envelope in each portion. The weighted average test results shall not exceed the whole building leakage limit. In the alternative approach, the following portions of the building shall be tested:

1. The entire envelope area of all stories that have any spaces directly under a roof.
2. The entire envelope area of all stories that have a building entrance, exposed floor, or loading dock, or are below grade.
3. Representative above-grade sections of the building totaling at least 25 percent of the wall area enclosing the remaining conditioned space.

Exception: Where the measured air leakage rate exceeds 0.40 cfm/ft^2 (2.0 L/s × m^2) but does not exceed 0.60 cfm/ft^2 (3.0 L/s × m^2), a diagnostic evaluation using smoke tracer or infrared imaging shall be conducted while the building is pressurized along with a visual inspection of the air barrier. Any leaks noted shall be sealed where such sealing can be made without destruction of existing building components. An additional report identifying the corrective actions taken to seal leaks shall be submitted to the code official and the building owner, and shall be deemed to comply with the requirements of this section.

 86

86

C402.5 - Comply with C402.5.1 through C402.5.8(2015 & 2018) or C402.5.11.1(2021)

2021 Approach

C402.5.3 Building thermal envelope testing

The *building thermal envelope* shall be tested in accordance with ASTM E779, ANSI/RESNET/ICC 380, ASTM E3158 or ASTM E1827 or an equivalent method approved by the code official. The measured air leakage shall not exceed 0.40 cfm/ft^2 (2.0 L/s × m^2) of the *building thermal envelope* area at a pressure differential of 0.3 inch water gauge (75 Pa).

https://www.familyhandyman.com/list/what-is-a-blower-door-test/

 87

87

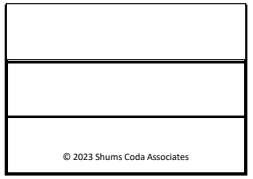
C402.5 - Comply with C402.5.1 through C402.5.8(2015 & 2018) or C402.5.11.1(2021)

2021 Approach

C402.5.3 Building thermal envelope testing.

Alternatively, portions of the building shall be tested and the measured air leakages shall be area weighted by the surface areas of the building envelope in each portion. The weighted average test results shall not exceed the whole building leakage limit. In the alternative approach, the following portions of the building shall be tested:

1. The entire envelope area of all stories that have any spaces directly under a roof.
2. The entire envelope area of all stories that have a building entrance, exposed floor, or loading dock, or are below grade.
3. Representative above-grade sections of the building totaling at least 25 percent of the wall area enclosing the remaining conditioned space.



 88

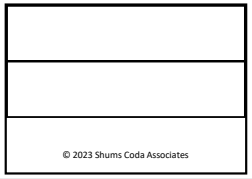
88

C402.5 - Comply with C402.5.1 through C402.5.8(2015 & 2018) or C402.5.11.1(2021)

C402.5.3 Building thermal envelope testing. *2021 Approach*

Alternatively, portions of the building shall be tested and the measured air leakages shall be area weighted by the surface areas of the building envelope in each portion. The weighted average test results shall not exceed the whole building leakage limit. In the alternative approach, the following portions of the building shall be tested:

1. The entire envelope area of all stories that have any spaces directly under a roof.
2. The entire envelope area of all stories that have a building entrance, exposed floor, or loading dock, or are below grade.
3. Representative above-grade sections of the building totaling at least 25 percent of the wall area enclosing the remaining conditioned space.



 89

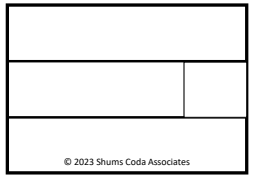
89

C402.5 - Comply with C402.5.1 through C402.5.8(2015 & 2018) or C402.5.11.1(2021)

C402.5.3 Building thermal envelope testing. *2021 Approach*

Alternatively, portions of the building shall be tested and the measured air leakages shall be area weighted by the surface areas of the building envelope in each portion. The weighted average test results shall not exceed the whole building leakage limit. In the alternative approach, the following portions of the building shall be tested:

1. The entire envelope area of all stories that have any spaces directly under a roof.
2. The entire envelope area of all stories that have a building entrance, exposed floor, or loading dock, or are below grade.
3. Representative above-grade sections of the building totaling at least 25 percent of the wall area enclosing the remaining conditioned space.



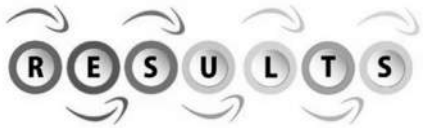
 90

90

C402.5 - Comply with C402.5.1 through C402.5.8(2015 & 2018) or C402.5.11.1(2021)

C402.5.3 Building thermal envelope testing *2021 Approach*

Exception: Where the measured air leakage rate exceeds 0.40 cfm/ft² but does not exceed 0.60 cfm/ft², a diagnostic evaluation using smoke tracer or infrared imaging shall be conducted while the building is pressurized along with a visual inspection of the air barrier. Any leaks noted shall be sealed where such sealing can be made without destruction of existing building components. An additional report identifying the corrective actions taken to seal leaks shall be submitted to the code official and the building owner, and shall be deemed to comply with the requirements of this section.



 91

91

C402.5 - Comply with C402.5.1 through C402.5.8(2015 & 2018) or C402.5.11.1(2021)

2021 Approach

C402.5.3 Building thermal envelope testing.

The *building thermal envelope* shall be tested in accordance with ASTM E779, ANSI/RESNET/ICC 380, ASTM E3158 or ASTM E1827 or an equivalent method approved by the code official. The measured air leakage shall not exceed 0.40 cfm/ft² (2.0 L/s × m²) of the *building thermal envelope* area at a pressure differential of 0.3 inch water gauge (75 Pa). Alternatively, portions of the building shall be tested and the measured air leakages shall be area weighted by the surface areas of the building envelope in each portion. The weighted average test results shall not exceed the whole building leakage limit. In the alternative approach, the following portions of the building shall be tested:

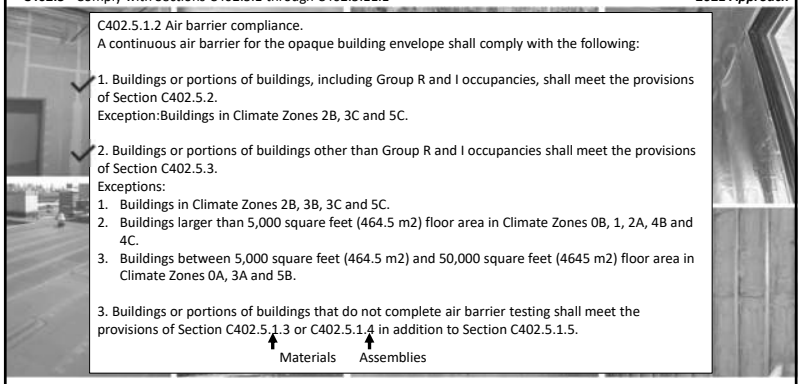
1. The entire envelope area of all stories that have any spaces directly under a roof.
2. The entire envelope area of all stories that have a building entrance, exposed floor, or loading dock, or are below grade.
3. Representative above-grade sections of the building totaling at least 25 percent of the wall area enclosing the remaining conditioned space.

Exception: Where the measured air leakage rate exceeds 0.40 cfm/ft² (2.0 L/s × m²) but does not exceed 0.60 cfm/ft² (3.0 L/s × m²), a diagnostic evaluation using smoke tracer or infrared imaging shall be conducted while the building is pressurized along with a visual inspection of the air barrier. Any leaks noted shall be sealed where such sealing can be made without destruction of existing building components. An additional report identifying the corrective actions taken to seal leaks shall be submitted to the code official and the building owner, and shall be deemed to comply with the requirements of this section.

 92

92

C402.5 - Comply with Sections C402.5.1 through C402.5.11.1 ***2021 Approach***



C402.5.1.2 Air barrier compliance.
A continuous air barrier for the opaque building envelope shall comply with the following:

1. Buildings or portions of buildings, including Group R and I occupancies, shall meet the provisions of Section C402.5.2.
Exception:Buildings in Climate Zones 2B, 3C and 5C.

2. Buildings or portions of buildings other than Group R and I occupancies shall meet the provisions of Section C402.5.3.
Exceptions:
1. Buildings in Climate Zones 2B, 3B, 3C and 5C.
2. Buildings larger than 5,000 square feet (464.5 m2) floor area in Climate Zones 0B, 1, 2A, 4B and 4C.
3. Buildings between 5,000 square feet (464.5 m2) and 50,000 square feet (4645 m2) floor area in Climate Zones 0A, 3A and 5B.

3. Buildings or portions of buildings that do not complete air barrier testing shall meet the provisions of Section C402.5.1.3 or C402.5.1.4 in addition to Section C402.5.1.5.

Materials Assemblies

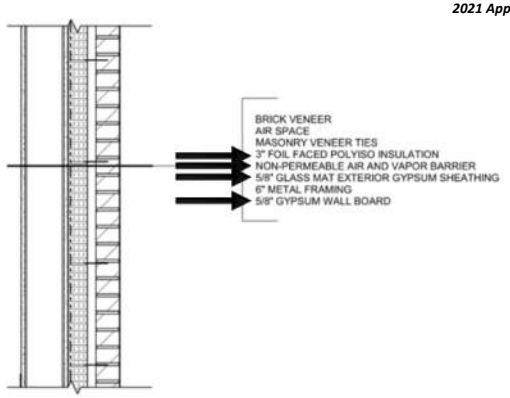
 93

93

C402.5 - Comply with C402.5.1 through C402.5.8(2015 & 2018) or C402.5.11.1(2021)

2021 Approach

What is the air barrier, and where is it located?

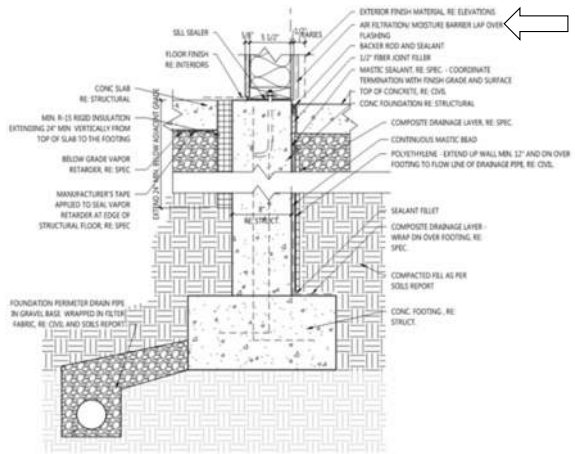


 94

94

C402.5 - Comply with C402.5.1 through C402.5.8(2015 & 2018) or C402.5.11.1(2021)

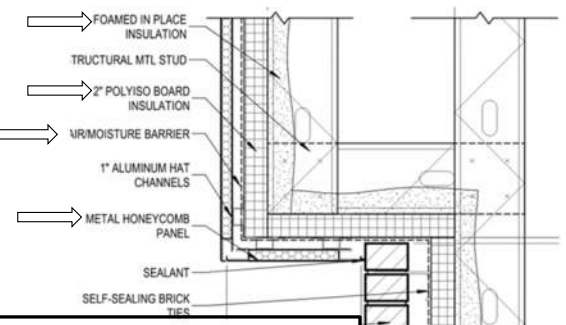
2021 Approach



 95

95

From the Spec Manual



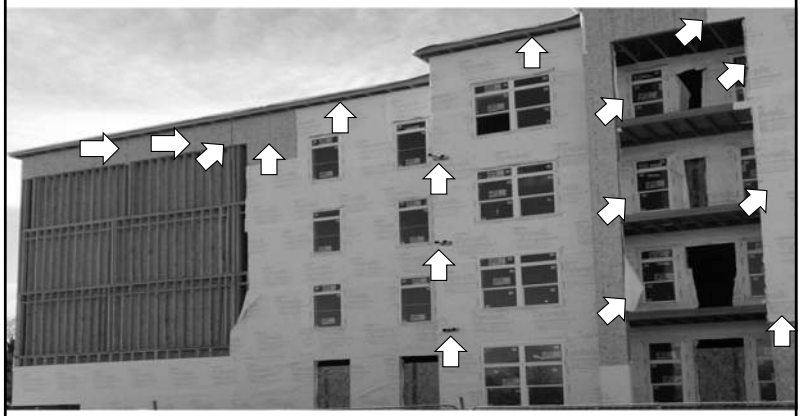
3.03 INSTALLATION

A. Install materials in accordance with manufacturer's instructions.

B. Air Barriers: Install continuous air tight barrier over surfaces indicated, with sealed seams and with sealed joints to adjacent surfaces.

 96

96



 97

97

- Don't place it in the spec manual only
- State on the plans what the actual air barrier material or assembly is and use the spec manual to support the design

3.03 INSTALLATION

A. Install materials in accordance with manufacturer's instructions.

B. Air Barriers: Install continuous air tight barrier over surfaces indicated, with sealed seams and with sealed joints to adjacent surfaces.

?

 98

98

C402.5 - Comply with C402.5.1 through C402.5.8(2015 & 2018) or C402.5.11.1(2021)

2021 Approach

Sections that support the physical air barrier material for the assembly

 99

99

C402.5 - Comply with C402.5.1 through C402.5.8(2015 & 2018) or C402.5.11.1(2021)

2015 & 2018 IECC

C402.5.2 Air leakage of fenestration. P The air leakage of fenestration assemblies shall meet the provisions of Table C402.5.2. Testing shall be in accordance with the applicable reference test standard in Table C402.5.2 by an accredited, independent testing laboratory and *labeled* by the manufacturer.

Exceptions:

1. Field-fabricated fenestration assemblies that are sealed in accordance with Section C402.5.1.
2. Fenestration in buildings that comply with the testing alternative of Section C402.5 are not required to meet the air leakage requirements in Table C402.5.2.

2021 IECC

C402.5.4 Air leakage of fenestration. The air leakage of fenestration assemblies shall meet the provisions of Table C402.5.4. Testing shall be in accordance with the applicable reference test standard in Table C402.5.4 by an accredited, independent testing laboratory and *labeled* by the manufacturer.

Exceptions:

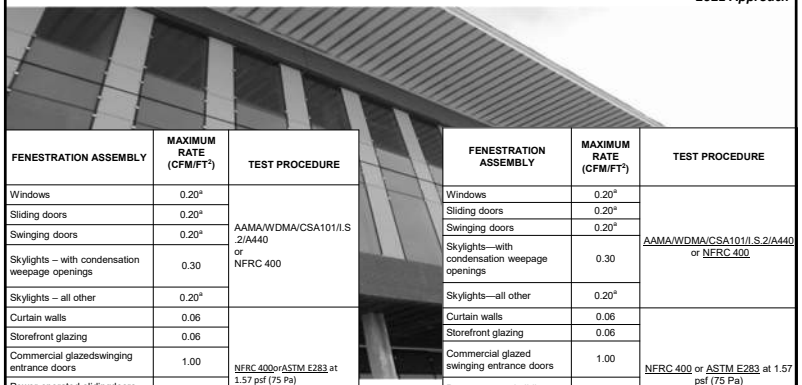
1. Field-fabricated fenestration assemblies that are sealed in accordance with Section C402.5.1.
2. Fenestration in buildings that comply with the testing alternative of Section C402.5 are not required to meet the air leakage requirements in Table C402.5.4.

 100

100

C402.5 - Comply with C402.5.1 through C402.5.8(2015 & 2018) or C402.5.11.1(2021)

2021 Approach

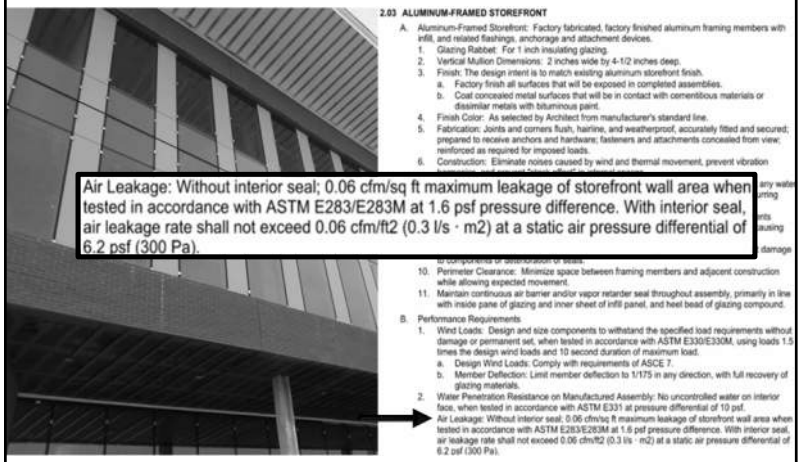


FENESTRATION ASSEMBLY	MAXIMUM RATE (CFM/FT^2)	TEST PROCEDURE
Windows	0.20[a]	AAMA/WDMA/CSA101/I.S.2/A440 or NFRC 400
Sliding doors	0.20[a]	
Swinging doors	0.20[a]	
Skylights – with condensation weepage openings	0.30	
Skylights – all other	0.20[a]	
Curtain walls	0.06	NFRC 400 or ASTM E283 at 1.57 psf (75 Pa)
Storefront glazing	0.06	
Commercial glazedswinging entrance doors	1.00	
Power-operated slidingdoors and poweroperated folding doors	1.00	
Revolving doors	1.00	
Garage doors	0.40	ANSI/DASMA 105, NFRC 400, or ASTM E283 at 1.57 psf (75 Pa)
Rolling doors	1.00	
High-speed doors	1.30	

FENESTRATION ASSEMBLY	MAXIMUM RATE (CFM/FT^2)	TEST PROCEDURE
Windows	0.20[a]	AAMA/WDMA/CSA101/I.S.2/A440 or NFRC 400
Sliding doors	0.20[a]	
Swinging doors	0.20[a]	
Skylights—with condensation weepage openings	0.30	
Skylights—all other	0.20[a]	
Curtain walls	0.06	NFRC 400 or ASTM E283 at 1.57 psf (75 Pa)
Storefront glazing	0.06	
Commercial glazed swinging entrance doors	1.00	
Power-operated sliding doors and power operated folding doors	1.00	
Revolving doors	1.00	
Garage doors	0.40	ANSI/DASMA 105, NFRC 400, or ASTM E283 at 1.57 psf (75 Pa)
Rolling doors	1.00	
High-speed doors	1.30	

101

C402.5 - Comply with C402.5.1 through C402.5.8(2015 & 2018) or C402.5.11.1(2021)



2.03 ALUMINUM-FRAMED STOREFRONT

A. Aluminum-Framed Storefront: Factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.
1. Glazing Rabbet: For 1 inch insulating glazing.
2. Vertical Mullion Dimensions: 2 inches wide by 4-1/2 inches deep.
3. Finish: The design intent is to match existing aluminum storefront finish.
a. Factory finish all surfaces that will be exposed in completed assemblies.
b. Coat concealed metal surfaces that will be in contact with cementitious materials or dissimilar metals with bituminous paint.
4. Finish Color: As selected by Architect from manufacturer's standard line.
5. Fabrication: Joints and corners flush, hairline, and weatherproof, accurately fitted and secured; prepared to receive anchors and hardware; fasteners and attachments concealed from view; reinforced as required for imposed loads.
6. Construction: Eliminate noises caused by wind and thermal movement, prevent vibration
10. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.
11. Maintain continuous air barrier and/or vapor retarder seal throughout assembly, primarily in line with inside pane of glazing and inner sheet of infill panel, and heel bead of glazing compound.

B. Performance Requirements
1. Wind Loads: Design and size components to withstand the specified load requirements without damage or permanent set, when tested in accordance with ASTM E330/E330M, using loads 1.5 times the design wind loads and 10 second duration of maximum load.
a. Design Wind Loads: Comply with requirements of ASCE 7.
b. Member Deflection: Limit member deflection to 1/175 in any direction, with full recovery of glazing materials.
2. Water Penetration Resistance on Manufactured Assembly: No uncontrolled water on interior face, when tested in accordance with ASTM E331 at pressure differential of 10 psf.
Air Leakage: Without interior seal; 0.06 cfm/sq ft maximum leakage of storefront wall area when tested in accordance with ASTM E283/E283M at 1.6 psf pressure difference. With interior seal, air leakage rate shall not exceed 0.06 cfm/ft2 (0.3 l/s · m2) at a static air pressure differential of 6.2 psf (300 Pa).

Air Leakage: Without interior seal; 0.06 cfm/sq ft maximum leakage of storefront wall area when tested in accordance with ASTM E283/E283M at 1.6 psf pressure difference. With interior seal, air leakage rate shall not exceed 0.06 cfm/ft2 (0.3 l/s · m2) at a static air pressure differential of 6.2 psf (300 Pa).

102

C402.5 - Comply with C402.5.1 through C402.5.8(2015 & 2018) or C402.5.11.1(2021)

C402.5.5 Rooms containing fuel-burning appliances.
In *Climate Zones* 3 through 8, where combustion air is supplied through openings in an exterior wall to a room or space containing a space-conditioning fuel-burning appliance, one of the following shall apply:
1.The room or space containing the appliance shall be located outside of the *building thermal envelope*.
2.The room or space containing the appliance shall be enclosed and isolated from conditioned spaces inside the *building thermal envelope*. Such rooms shall comply with all of the following:
2.1.The walls, floors and ceilings that separate the enclosed room or space from conditioned spaces shall be insulated to be not less than equivalent to the insulation requirement of below-grade walls as specified in Table C402.1.3 or Table C402.1.4.
2.2.The walls, floors and ceilings that separate the enclosed room or space from conditioned spaces shall be sealed in accordance with Section C402.5.1.1.
2.3.The doors into the enclosed room or space shall be fully gasketed.
2.4.Water lines and ducts in the enclosed room or space shall be insulated in accordance with Section C403.
2.5.Where an air duct supplying combustion air to the enclosed room or space passes through *conditioned space*, the duct shall be insulated to an *R*-value of not less than R-8.
Exception:
1.Direct vent appliances with both intake and exhaust pipes installed continuous to the outside.
2.Fireplaces and stoves complying with Section R402.4.2 and Section R1006 of the International Residential Code

103

C402.5 - Comply with C402.5.1 through C402.5.8(2015 & 2018) or C402.5.11.1(2021)

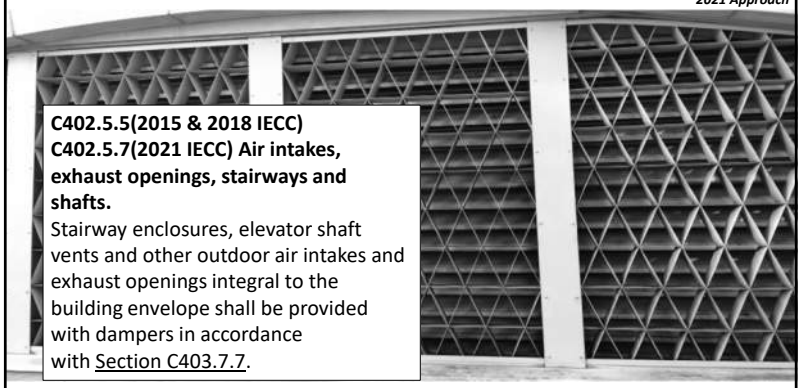
2021 Approach

C402.5.4(2018 IECC) C402.5.6(2021 IECC) Doors and access openings to shafts, chutes, stairways and elevator lobbies.
Doors and *access* openings from conditioned space to shafts, chutes stairways and elevator lobbies not within the scope of the fenestration assemblies covered by Section C402.5.4 shall be gasketed, weather-stripped or sealed.
Exceptions:
1.Door openings required to comply with Section 716 of the *International Building Code*.
2.Doors and door openings required to comply with UL 1784 by the *International Building Code*.

104

C402.5 - Comply with C402.5.1 through C402.5.8(2015 & 2018) or C402.5.11.1(2021)

2021 Approach



C402.5.5(2015 & 2018 IECC)
C402.5.7(2021 IECC) Air intakes, exhaust openings, stairways and shafts.
Stairway enclosures, elevator shaft vents and other outdoor air intakes and exhaust openings integral to the building envelope shall be provided with dampers in accordance with Section C403.7.7.

 105

105

C403.7.7 Shutoff dampers

Outdoor air intake and exhaust openings and stairway and shaft vents shall be provided with Class I motorized dampers. The dampers shall have an air leakage rate not greater than 4 cfm/ft2 of damper surface area at 1.0 inch water gauge and shall be labeled by an approved agency when tested in accordance with AMCA 500D for such purpose.

Outdoor air intake and exhaust dampers shall be installed with automatic controls configured to close when the systems or spaces served are not in use or during unoccupied period warm-up and setback operation, unless the systems served require outdoor or exhaust air in accordance with the International Mechanical Code or the dampers are opened to provide intentional economizer cooling.

Stairway and shaft vent dampers shall be installed with automatic controls configured to open upon the activation of any fire alarm initiating device of the building's fire alarm system or the interruption of power to the damper

 106

106

C403.7.7 Shutoff dampers

Exception: Nonmotorized gravity dampers shall be an alternative to motorized dampers for exhaust and relief openings as follows:

1. In buildings less than three stories in height above grade plane.
2. In buildings of any height located in Climate Zones 0, 1, 2 or 3.
3. Where the design exhaust capacity is not greater than 300 cfm (.

Nonmotorized gravity dampers shall have an air leakage rate not greater than 20 cfm/ft2 where not less than 24 inches in either dimension and 40 cfm/ft2 where less than 24 inche in either dimension.

The rate of air leakage shall be determined at 1.0 inch water gauge when tested in accordance with AMCA 500D for such purpose.

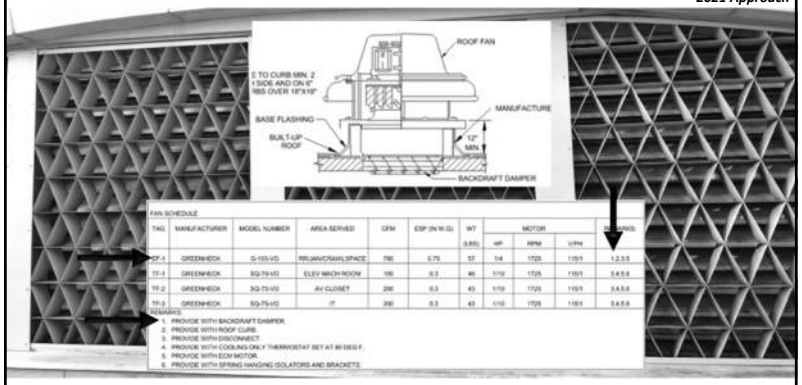
The dampers shall be labeled by an approved agency

 107

107

C402.5 - Comply with C402.5.1 through C402.5.8(2015 & 2018) or C402.5.11.1(2021)

2021 Approach

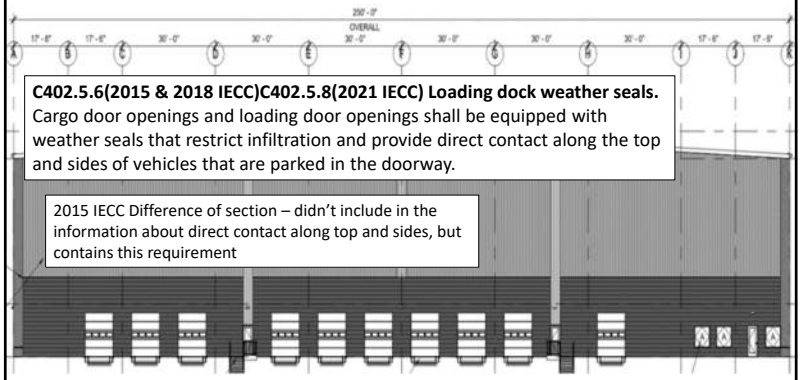


 108

108

C402.5 - Comply with C402.5.1 through C402.5.8(2015 & 2018) or C402.5.11.1(2021)

2021 Approach

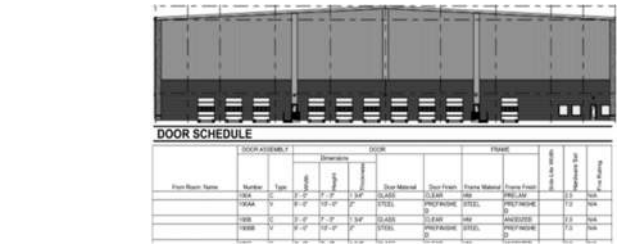


C402.5.6(2015 & 2018 IECC)C402.5.8(2021 IECC) Loading dock weather seals. Cargo door openings and loading door openings shall be equipped with weather seals that restrict infiltration and provide direct contact along the top and sides of vehicles that are parked in the doorway.

2015 IECC Difference of section – didn't include in the information about direct contact along top and sides, but contains this requirement

 109

109



DOOR SCHEDULE

Set: 7.0
Doors: 100AA, 100BB, 100CC, 100EE, 100R, 100T, 100U, 100V, 100X, 100Y, 100Z

SECTION 083323 - OVERHEAD COILING DOORS

1 Hardware — Door manufacturer — OT

A. Weatherseals for Exterior Doors: Equip each exterior door with weather-stripping gaskets fitted to entire perimeter of door for a weathertight installation, unless otherwise indicated.

1. At door head, use 1/8 in (3 mm) thick, replaceable, continuous sheet secured to inside of hood.
2. At door jambs, use replaceable, adjustable, continuous, flexible, 1/8 in (3 mm) thick seals of flexible vinyl, rubber, or neoprene.

 110

110

C402.5 - Comply with C402.5.1 through C402.5.8(2015 & 2018) or C402.5.11.1(2021)

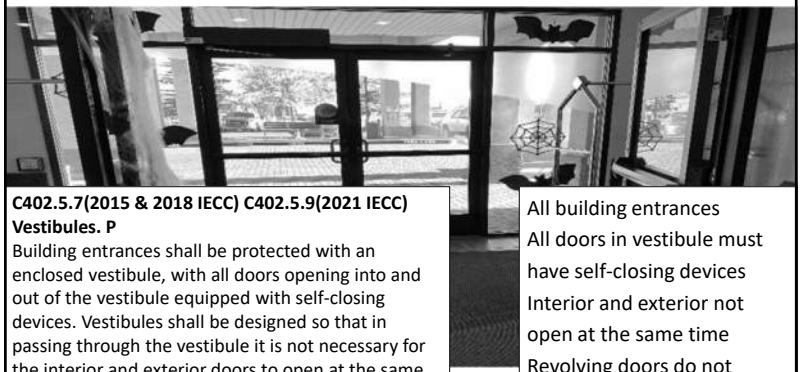
2021 Approach

 111

111

C402.5 - Comply with C402.5.1 through C402.5.8(2015 & 2018) or C402.5.11.1(2021)

2021 Approach



C402.5.7(2015 & 2018 IECC) C402.5.9(2021 IECC) Vestibules. P
Building entrances shall be protected with an enclosed vestibule, with all doors opening into and out of the vestibule equipped with self-closing devices. Vestibules shall be designed so that in passing through the vestibule it is not necessary for the interior and exterior doors to open at the same time. The installation of one or more revolving doors in the *building entrance* shall not eliminate the requirement that a vestibule be provided on any doors adjacent to revolving doors.

All building entrances
All doors in vestibule must have self-closing devices
Interior and exterior not open at the same time
Revolving doors do not exclude vestibule requirement for doors adjacent to revolving doors

 112

112

C402.5 - Comply with C402.5.1 through C402.5.8(2015 & 2018) or C402.5.11.1(2021)

C402.5.7(2015 & 2018 IECC) C402.5.9(2021 IECC)
Exceptions:

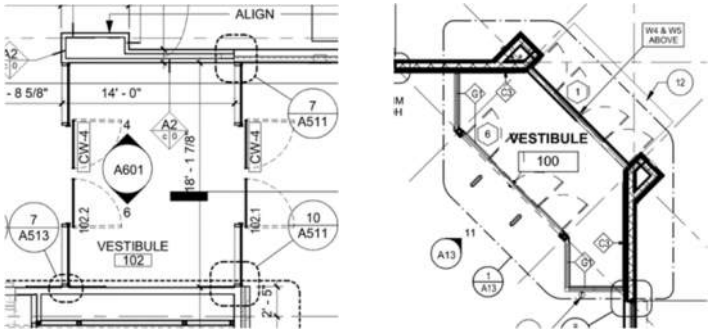
1. Buildings in Climate Zones 0 through 2.
2. Doors not intended to be used by the public, such as doors to mechanical or electrical equipment rooms, or intended solely for employee use.
3. Doors opening directly from a sleeping unit or dwelling unit.
4. Doors that open directly from a space less than 3,000 square feet (298 m2) in area.
5. Revolving doors.
6. Doors used primarily to facilitate vehicular movement or material handling and adjacent personnel doors.
7. Doors that have an air curtain with a velocity of not less than 6.56 feet per second (2 m/s) at the floor that have been tested in accordance with ANSI/AMCA 220 and installed in accordance with the manufacturer's instructions. Manual or automatic controls shall be provided that will operate the air curtain with the opening and closing of the door. Air curtains and their controls shall comply with Section C408.2.3.

 113

113

C402.5 - Comply with C402.5.1 through C402.5.8(2015 & 2018) or C402.5.11.1(2021)

2021 Approach



 114

114

C402.5 - Comply with C402.5.1 through C402.5.8(2015 & 2018) or C402.5.11.1(2021)

2021 Approach

 115

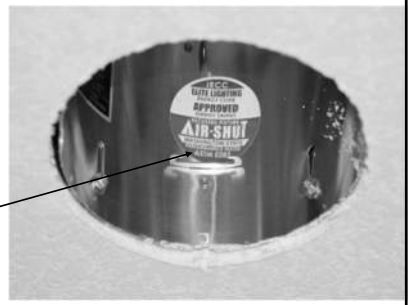
115

C402.5 - Comply with C402.5.1 through C402.5.8(2015 & 2018) or C402.5.11.1(2021)

2021 Approach

C402.5.8(2015 & 2018)
C402.5.10(2021 IECC) Recessed lighting.
Recessed luminaires installed in the *building thermal envelope* shall be all of the following:

1. IC-rated.
2. Labeled as having an air leakage rate of not more 2.0 cfm when tested in accordance with ASTM E283 at a 1.57 psf pressure differential.
3. Sealed with a gasket or caulk between the housing and interior wall or ceiling covering.



 116

116

C402.5 - Comply with C402.5.1 through C402.5.8(2015 & 2018) or C402.5.11.1(2021) ***2021 Approach***

C402.5.11 Operable openings interlocking.
Where occupancies utilize operable openings to the outdoors that are larger than 40 square feet (3.7 m^2) in area, such openings shall be interlocked with the heating and cooling system so as to raise the cooling setpoint to 90°F (32°C) and lower the heating setpoint to 55°F (13°C) whenever the operable opening is open. The change in heating and cooling setpoints shall occur within 10 minutes of opening the operable opening.

Exceptions:

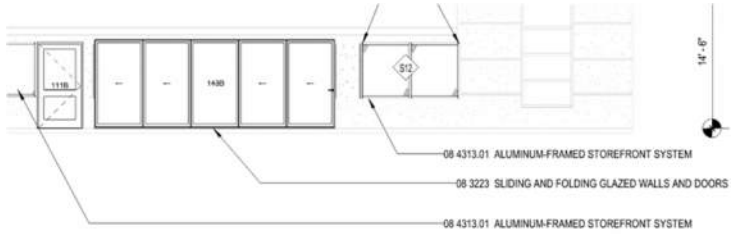
1. Separately zoned areas associated with the preparation of food that contain appliances that contribute to the HVAC loads of a restaurant or similar type of occupancy.
2. Warehouses that utilize overhead doors for the function of the occupancy, where approved by the code official.
3. The first entrance doors where located in the exterior wall and are part of a vestibule system.

 117

117

C402.5 - Comply with C402.5.1 through C402.5.8(2015 & 2018) or C402.5.11.1(2021)

2021 Approach



 118

118

C406 – Additional Efficiency Package Option
How it works for the 2018 IECC

- Pick one of the options that works best for the project
- Make sure all documents reference the same option

 119

119



2018 IECC OPTIONS

C406.2 More Efficient HVAC Equipment Performance
C406.3 Reduced Lighting Power
C406.4 Enhanced Digital Lighting Controls
C406.5 On-site Renewable Energy
C406.6 Dedicated Outdoor Air System
C406.7 Reduced Energy Use In Service Water Heating
C406.8 Enhanced Envelope Performance
C406.9 Reduced Air Infiltration





 120

120

C406 – Additional Efficiency Requirements How it works for the 2021 IECC

- More options available
- Required to obtain 10 points for new building
- Required to obtain 5 points for tenant spaces
- Available points are weighted by occupancy and the efficiency provided for the occupancy
- Not all requirements are available for all occupancies
- Most will require multiple requirements to reach the required points
- Will require more planning in the design

 121

121

(2021 IECC)

YFGQJ%H95;36-:.
FIINYNTSFQ%JSJWL^%JKKNHNJSH^%HWJINYX%KTW%TYMJW%THHZUFSHNJX

SECTION	CLIMATE ZONE																
	0A & 1A	0B & 1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
C406.2.1: 5% heating efficiency improvement	NA	NA	NA	NA	1	1	1	1	1	2	1	2	1	2	2	3	3
C406.2.2: 5% cooling efficiency improvement	5	5	4	4	3	3	2	2	2	1	1	2	1	1	1	1	1
C406.2.3: 10% heating efficiency improvement	NA	NA	NA	1	1	1	1	2	2	3	3	3	3	4	3	5	5
C406.2.4: 10% cooling efficiency improvement	8	9	8	7	5	5	3	4	4	2	2	3	2	2	2	2	2
C406.3: Reduced lighting power	8	8	9	9	9	9	10	8	9	9	7	8	8	8	8	8	7
C406.4: Enhanced digital lighting controls	2	2	2	2	2	2	2	2	2	2	2	3	2	2	2	2	1
C406.5: On-site renewable energy	8	8	8	8	8	8	8	8	8	7	7	7	7	7	7	7	7
C406.6: Dedicated outdoor air system	3	4	3	3	4	3	2	5	3	3	5	4	3	7	5	7	6
C406.7.2: Recovered or renewable water heating[b]	10	9	11	10	13	12	15	14	14	15	14	14	16	14	15	15	15
C406.7.3: Efficient fossil fuel water heater[b]	5	5	6	6	8	7	8	8	8	9	9	9	10	10	9	10	11
C406.7.4: Heat pump water heater[b]	6	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
C406.8: Enhanced envelope performance	3	6	3	4	3	4	1	5	4	3	5	5	4	7	6	9	10
C406.9: Reduced air infiltration	3	2	2	4	4	2	NA	6	2	2	6	4	1	10	5	7	4
C406.10: Energy monitoring	3	3	3	3	3	3	3	3	3	3	2	3	2	2	2	3	2
C406.11: Fault detection and diagnostics system	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1

 122

122

(2021 IECC) C406.1 Additional Energy Efficiency Credit Requirements

1. More efficient HVAC performance in accordance with Section C406.2.
2. Reduced lighting power in accordance with Section C406.3.
3. Enhanced lighting controls in accordance with Section C406.4.
4. On-site supply of renewable energy in accordance with Section C406.5.
5. Provision of a dedicated outdoor air system for certain HVAC equipment in accordance with Section C406.6.
6. High-efficiency service water heating in accordance with Section C406.7.
7. Enhanced envelope performance in accordance with Section C406.8.
8. Reduced air infiltration in accordance with Section C406.9
9. Where not required by Section C405.12, include an energy monitoring system in accordance with Section C406.10.
10. Where not required by Section C403.2.3, include a fault detection and diagnostics (FDD) system in accordance with Section C406.11.
11. Efficient kitchen equipment in accordance with Section C406.12.

 123

123

C406.9 Reduced air infiltration

Fnw%nskqywfyts%xmfqq%gj%{jwnkji%g~%|mtqj2gznqinsl%uwjxxzwn;fyts%yjxynsl% htsizhyji%ns%fhhtwifshj%|nym FXYR %J<<> tw FXYR %J6=7< g~%fs% nsijujsijsy%ymnwi%ufwy~3%

Ymj%r jfxzwji%fnw2qjfpflj%wfyj%tk%ymj%gznqinsl%js{jqtuj%xmfqq%sty%j}hjji% 537:%hkr 4ky[7] zsijw%f%uwjxxzwj%inkkjwjsynfq%tk%53 8%nshmjx%| fyjw%htqzr s%<:% Uf.1%| nym%ymj%hfqhzqfyji%xzwkfhj%fwjf%gjnsl%ymj%xzr %tk%ymj%fgt{j2%fsi% gjqt| 2lwfij%gznqinsl%js{jqtuj3%

F%wjutwy%ymfy%nshqzijx%ymj%yjxyji%xzwkfhj%fwjf1%kqttw%fwjf1%fnw%g~%{tqzr j1% xytwnjx%fgt{j%lwfij1%fsi%qjfpflj%wfyjx%xmfqq%gj%xzgr nyyji%yt%ymj%htij% tkknhnfq%fsi%ymj%gznqinsl%t| sjw3

J}hjuyts?

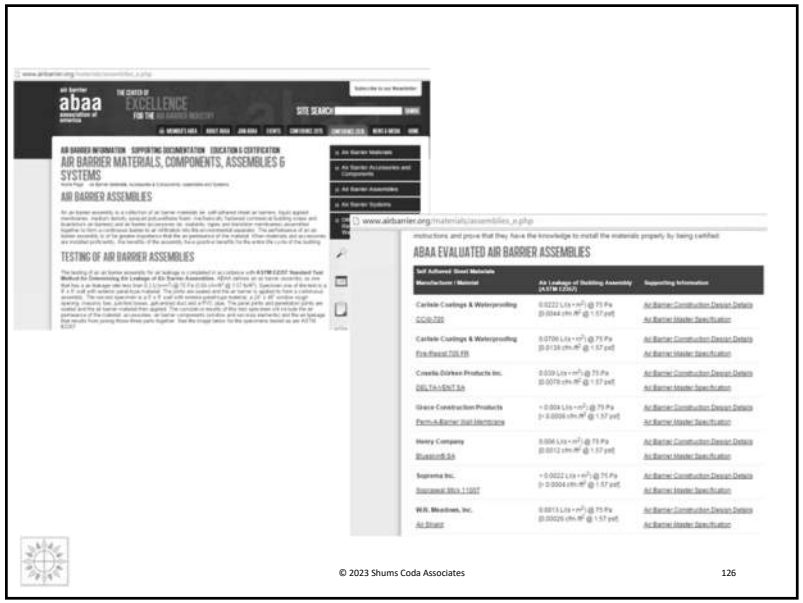
Ktw gznqinslx mf{nsl t{jw 7:1555 xvzfwj kjjy -7: 555 r [7]. tk htsinyntsji kqttw fwjf1 fnw qjfpflj yjxynsl sjji sty gj htsizhyji ts ymj | mtqj gznqinsl | mjwj yjxynsl nx htsizhyji ts wjuwjxjsyfyn{j fgt{j2lwfij xjhyntsx tk ymj gznqinsl3

Yjxyji fwjfx xmfqq ytyfq sty qjxx ymfs 7: ujwhjsy tk ymj htsinyntsji kqttw fwjf fsi xmfqq gj yjxyji ns fhhtwifshj | nym ymnx xjhynts3

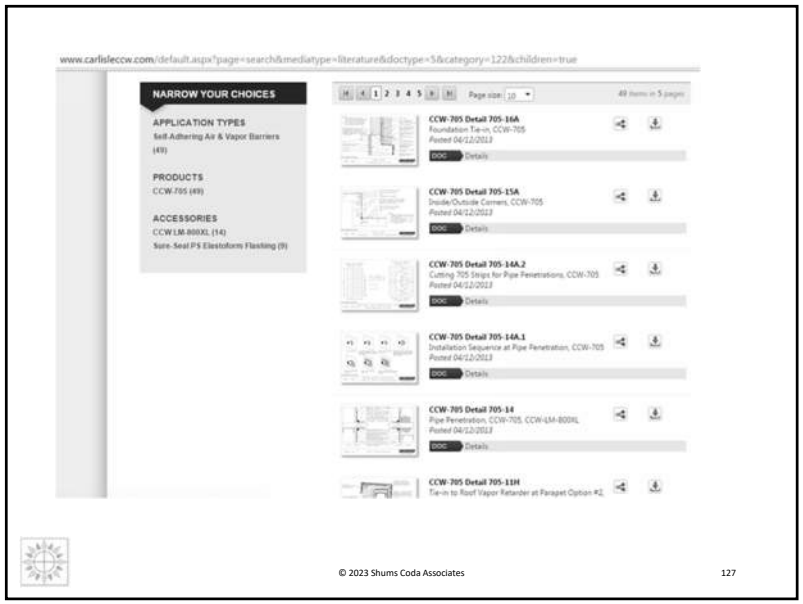
 124

124

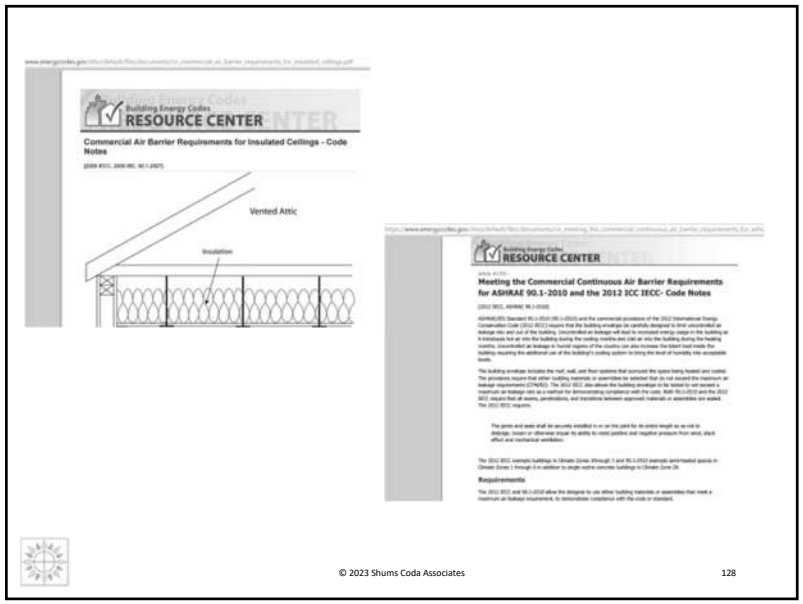
125



126



127



128

- Code analysis
  - List what option for air leakage if 2018 or earlier edition
  - List material or assembly that is part of air barrier assembly design
  - If using reduced air leakage to comply with C406

 129

129

On Plans

Air Barrier Material / Assembly

Seal Joints and Seams

Material needs special installation to meet air permeability as tested

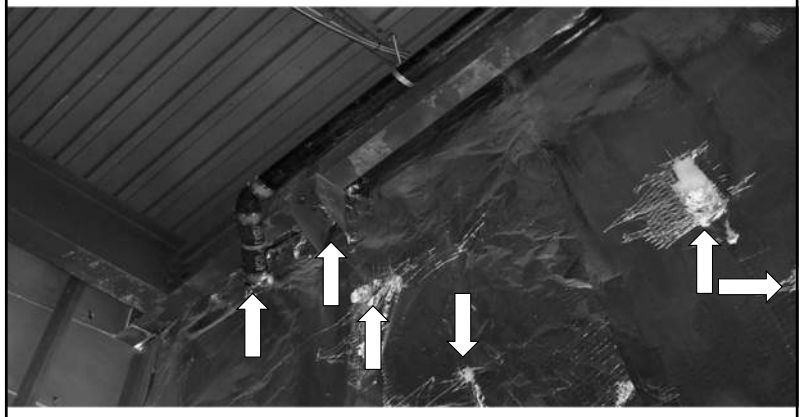
In Spec Book

Air leakage of fenestration

Loading dock weather sealing – if all door info is in spec

 130

130



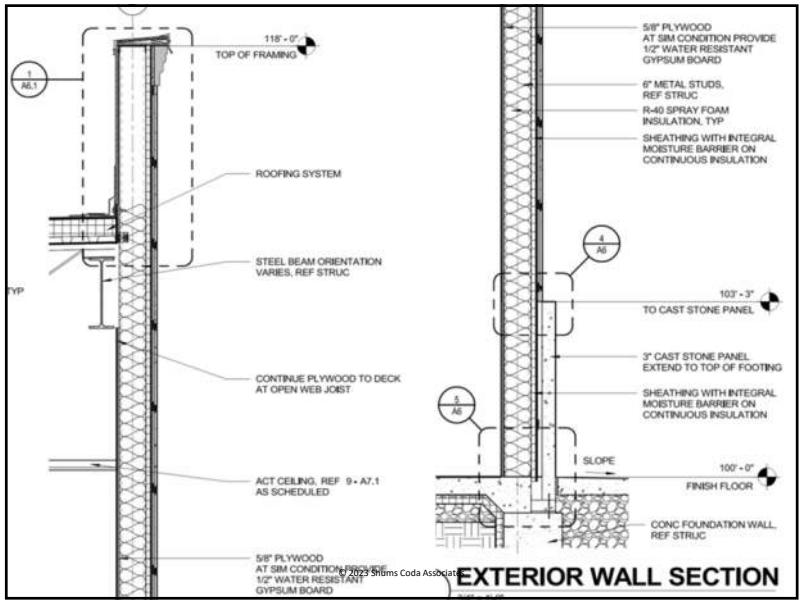
 131

131

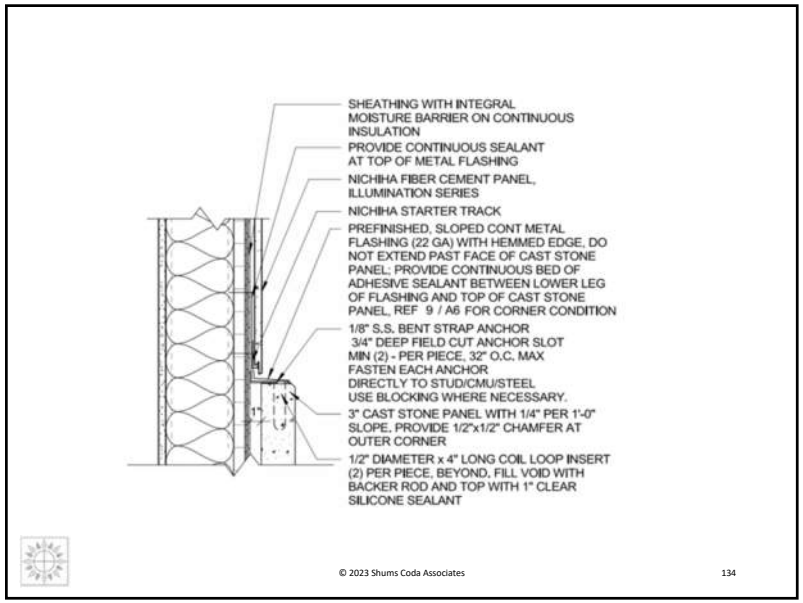
https://shumscoda-my.sharepoint.com/personal/gil_rossmiller_shumscoda_com/Documents/Documents/Documents/CCC/Classes/2021%20I%20Codes/2021%20IECC/McDonald%20dealership%20and%20Plans/installation-procedures-for-the-dupont-thermax-wall-system-43-d100144-enus.pdf

 132

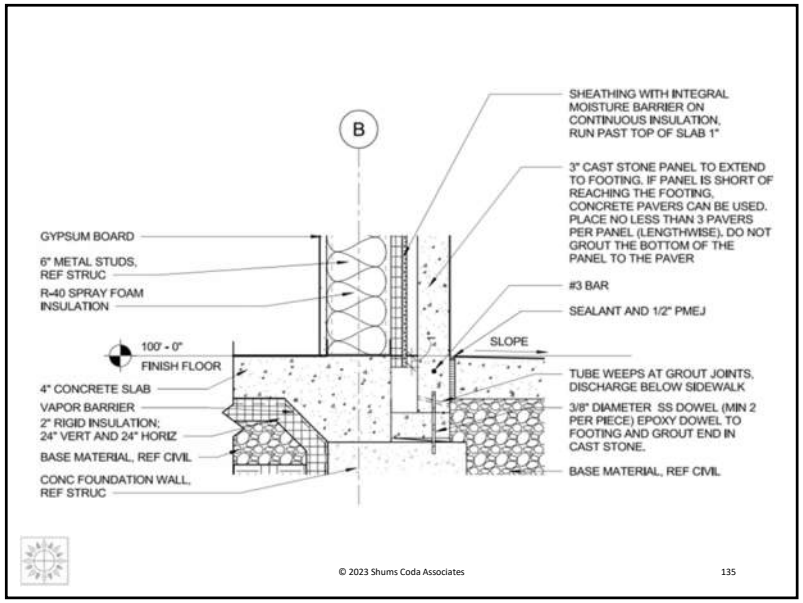
132



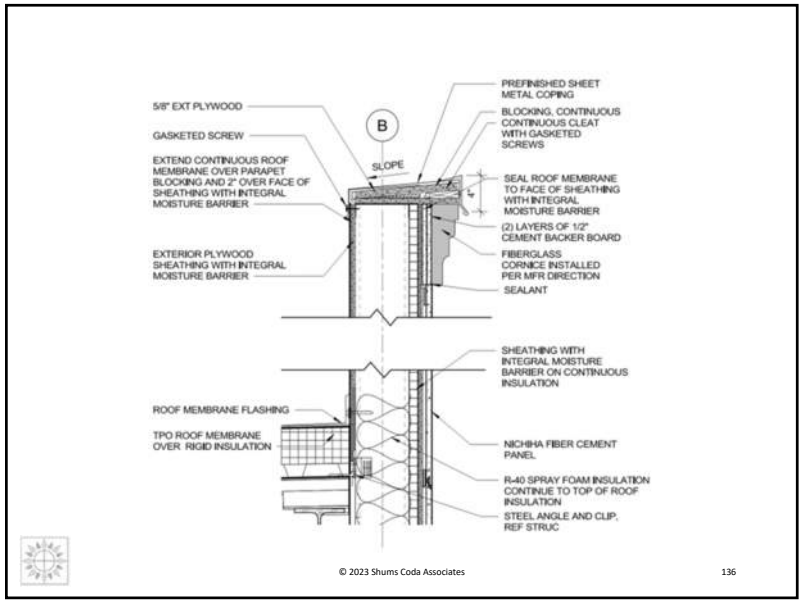
133



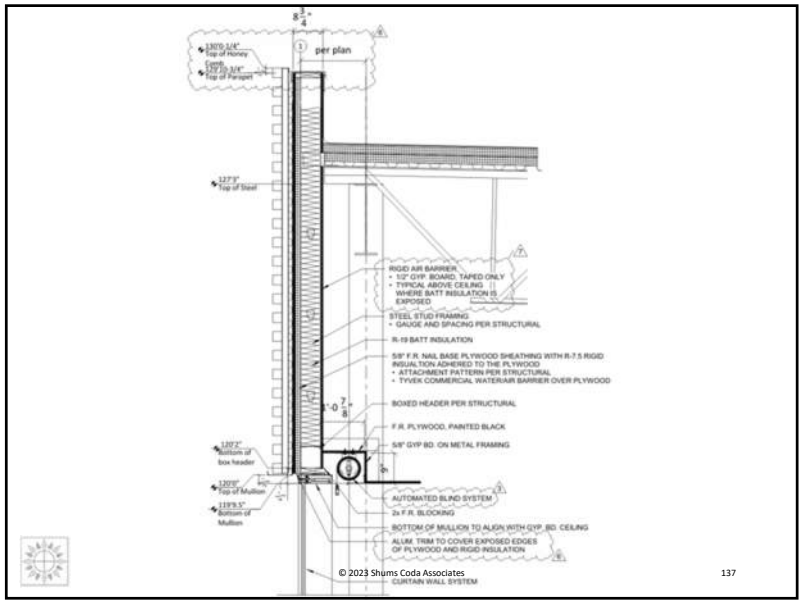
134



135

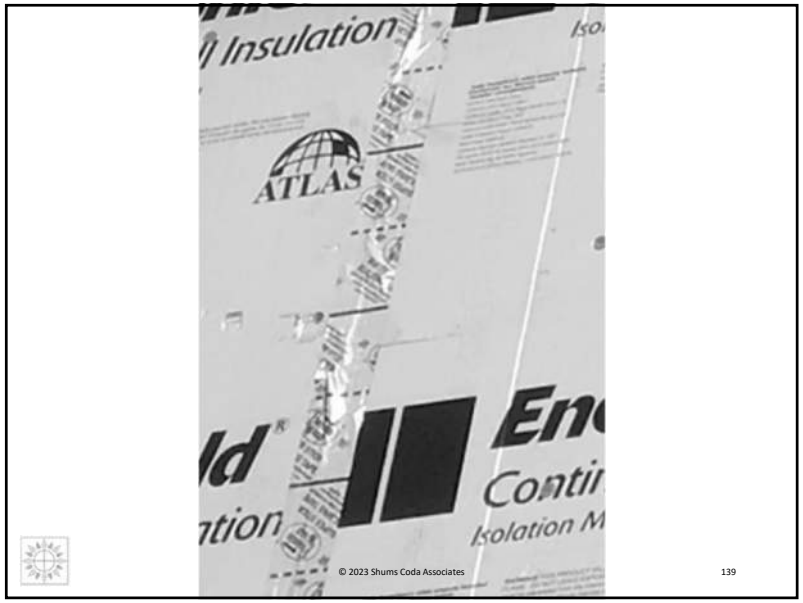


136



137

138



139

140

 141

141

 142

142

 143

143

 144

144

 145

145

Foam as an air sealant?

Material	Thickness (minimum)
Plywood	3/8 in.
Oriented strand board	3/8 in.
Extruded polystyrene insulation board	½ in.
Foil-faced urethane insulation board	½ in.
Closed cell spray foam minimum density of 1.5 pcf	1-1/2 in.
Open cell spray foam density between 0.4 and 1.5 pcf	4.5 in.
Exterior gypsum sheathing or interior gypsum board	½ in.
Cement board	½ in.
Built up roofing membrane	
Modified bituminous roof membrane	
Fully adhered single-ply roof membrane	
A Portland cement/sand parge, stucco, or gypsum plaster	5/8 in.
Cast-in-place and precast concrete	
Sheet metal or aluminum	
Solid or hollow masonry constructed of clay or shale masonry units	

 146

146

 147

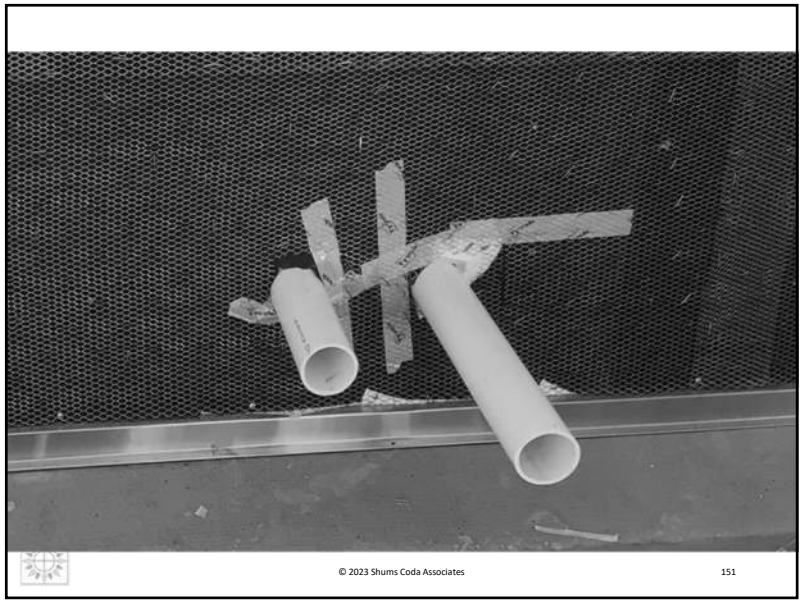
147

 148

148

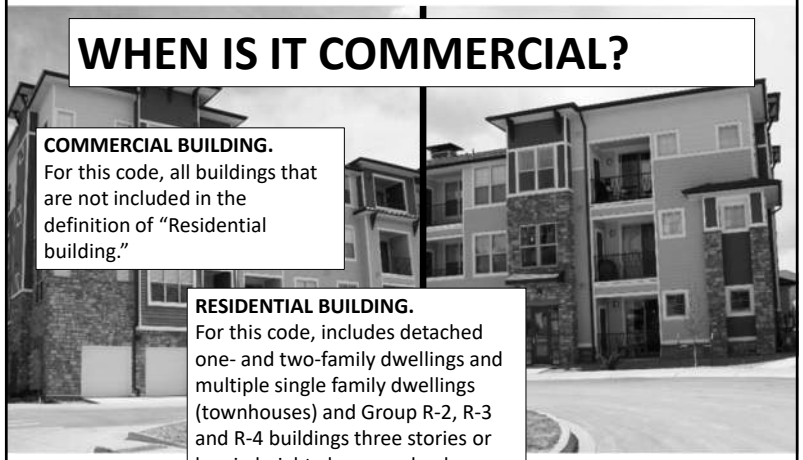
149

150



151

152



WHEN IS IT COMMERCIAL?

COMMERCIAL BUILDING.
For this code, all buildings that are not included in the definition of "Residential building."

RESIDENTIAL BUILDING.
For this code, includes detached one- and two-family dwellings and multiple single family dwellings (townhouses) and Group R-2, R-3 and R-4 buildings three stories or less in height above grade plane.

 153

153

R402.4 Air leakage

R402.4 Air leakage

The building thermal envelope shall be constructed to limit air leakage in accordance with the requirements of Sections R402.4.1 through R402.4.5.

R402.4.1 Building thermal envelope

The building thermal envelope shall comply with Sections R402.4.1.1 through R402.4.1.3. The sealing methods between dissimilar materials shall allow for differential expansion and contraction.

 154

154

R402.4 Air leakage

R402.4.1.1 Installation

The components of the building thermal envelope as indicated in Table R402.4.1.1 shall be installed in accordance with the manufacturer's instructions and the criteria indicated in Table R402.4.1.1, as applicable to the method of construction.

Where required by the code official, an approved third party shall inspect all components and verify compliance.

155

R402.4 Air leakage

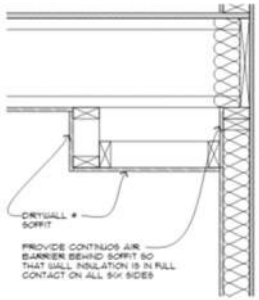
TABLE R402.4.1.1
AIR BARRIER, AIR SEALING AND INSULATION INSTALLATION[a]

COMPONENT	AIR BARRIER CRITERIA	INSULATION INSTALLATION CRITERIA
General requirements	A continuous air barrier shall be installed in the building envelope. Breaks or joints in the air barrier shall be sealed.	Air-permeable insulation shall not be used as a sealing material.

 156

156

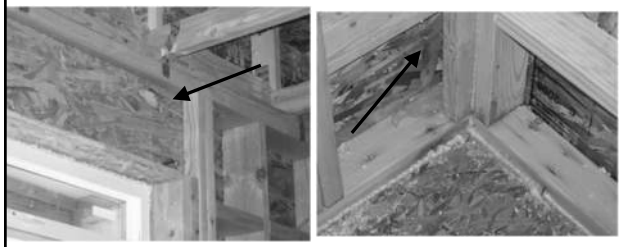
TABLE R402.4.1.1 AIR BARRIER, AIR SEALING AND INSULATION INSTALLATION [a]		
COMPONENT	AIR BARRIER CRITERIA	INSULATION INSTALLATION CRITERIA
Ceiling/attic	The air barrier in any dropped ceiling or soffit shall be aligned with the insulation and any gaps in the air barrier shall be sealed. Access openings, drop down stairs or knee wall doors to unconditioned attic spaces shall be sealed.	The insulation in any dropped ceiling/soffit shall be aligned with the air barrier.



 157

157

TABLE R402.4.1.1 AIR BARRIER, AIR SEALING AND INSULATION INSTALLATION [a]		
COMPONENT	AIR BARRIER CRITERIA	INSULATION INSTALLATION CRITERIA
Walls	The junction of the foundation and sill plate shall be sealed. The junction of the top plate and the top of exterior walls shall be sealed. Knee walls shall be sealed.	Cavities within corners and headers of frame walls shall be insulated by completely filling the cavity with a material having a thermal resistance, R-value, of not less than R-3 per inch. Exterior thermal envelope insulation for framed walls shall be installed in substantial contact and continuous alignment with the air barrier.



 158

158

TABLE R402.4.1.1 AIR BARRIER, AIR SEALING AND INSULATION INSTALLATION [a]		
COMPONENT	AIR BARRIER CRITERIA	INSULATION INSTALLATION CRITERIA
Windows, skylights and doors	The space between framing and skylights, and the jambs of windows and doors, shall be sealed.	—

159

159

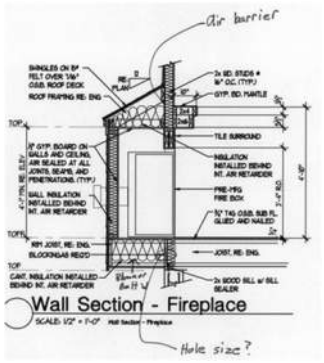
TABLE R402.4.1.1 AIR BARRIER, AIR SEALING AND INSULATION INSTALLATION [a]		
COMPONENT	AIR BARRIER CRITERIA	INSULATION INSTALLATION CRITERIA
Rim joists	Rim joists shall include an exterior air barrier.[b] The junctions of the rim board to the sill plate and the rim board and the subfloor shall be air sealed.	Rim joists shall be insulated so that the insulation maintains permanent contact with the exterior rim board.[b]

 160

160

TABLE R402.4.1.1
AIR BARRIER, AIR SEALING AND INSULATION INSTALLATION [a]

COMPONENT	AIR BARRIER CRITERIA	INSULATION INSTALLATION CRITERIA
Floors, including cantilevered floors and floors above garages	The air barrier shall be installed at any exposed edge of insulation.	Floor framing cavity insulation shall be installed to maintain permanent contact with the underside of subfloor decking. Alternatively, floor framing cavity insulation shall be in contact with the top side of sheathing, or continuous insulation installed on the underside of floor framing and extending from the bottom to the top of all perimeter floor framing members.



Coda Associates 161

161

TABLE R402.4.1.1
AIR BARRIER, AIR SEALING AND INSULATION INSTALLATION [a]

COMPONENT	AIR BARRIER CRITERIA	INSULATION INSTALLATION CRITERIA
Basement crawl space and slab foundations	Exposed earth in unvented crawl spaces shall be covered with a Class I vapor retarder/air barrier in accordance with Section R402.2.10. Penetrations through concrete foundation walls and slabs shall be air sealed. Class 1 vapor retarders shall not be used as an air barrier on below-grade walls and shall be installed in accordance with Section R702.7 of the International Residential Code.	Crawl space insulation, where provided instead of floor insulation, shall be installed in accordance with Section R402.2.10. Conditioned basement foundation wall insulation shall be installed in accordance with Section R402.2.8.1. Slab-on-grade floor insulation shall be installed in accordance with Section R402.2.10.

162

TABLE R402.4.1.1
AIR BARRIER, AIR SEALING AND INSULATION INSTALLATION [a]

COMPONENT	AIR BARRIER CRITERIA	INSULATION INSTALLATION CRITERIA
Shafts, penetrations	Duct and flue shafts to exterior or unconditioned space shall be sealed. Utility penetrations of the air barrier shall be caulked, gasketed or otherwise sealed and shall allow for expansion, contraction of materials and mechanical vibration.	Insulation shall be fitted tightly around utilities passing through shafts and penetrations in the building thermal envelope to maintain required R-value.

163

TABLE R402.4.1.1
AIR BARRIER, AIR SEALING AND INSULATION INSTALLATION [a]

COMPONENT	AIR BARRIER CRITERIA	INSULATION INSTALLATION CRITERIA
Narrow cavities	Narrow cavities of 1 inch or less that are not able to be insulated shall be air sealed.	Batts to be installed in narrow cavities shall be cut to fit or narrow cavities shall be filled with insulation that on installation readily conforms to the available cavity space.

© 2023 Shums Coda Associates 164

164

TABLE R402.4.1.1
AIR BARRIER, AIR SEALING AND INSULATION INSTALLATION [a]

COMPONENT	AIR BARRIER CRITERIA	INSULATION INSTALLATION CRITERIA
Garage separation	Air sealing shall be provided between the garage and conditioned spaces.	Insulated portions of the garage separation assembly shall be installed in accordance with Sections R303 and R402.2.7.

165

165

TABLE R402.4.1.1
AIR BARRIER, AIR SEALING AND INSULATION INSTALLATION [a]

COMPONENT	AIR BARRIER CRITERIA	INSULATION INSTALLATION CRITERIA
Recessed lighting	Recessed light fixtures installed in the building thermal envelope shall be air sealed in accordance with Section R402.4.5.	Recessed light fixtures installed in the building thermal envelope shall be airtight and IC rated, and shall be buried or surrounded with insulation.

166

166

TABLE R402.4.1.1
AIR BARRIER, AIR SEALING AND INSULATION INSTALLATION [a]

COMPONENT	AIR BARRIER CRITERIA	INSULATION INSTALLATION CRITERIA
Plumbing, wiring or other obstructions	All holes created by wiring, plumbing or other obstructions in the air barrier assembly shall be air sealed.	Insulation shall be installed to fill the available space and surround wiring, plumbing, or other obstructions, unless the required R-value can be met by installing insulation and air barrier systems completely to the exterior side of the obstructions.

167

167

TABLE R402.4.1.1
AIR BARRIER, AIR SEALING AND INSULATION INSTALLATION [a]

COMPONENT	AIR BARRIER CRITERIA	INSULATION INSTALLATION CRITERIA
Shower/tub on exterior wall	The air barrier installed at exterior walls adjacent to showers and tubs shall separate the wall from the shower or tub.	Exterior walls adjacent to showers and tubs shall be insulated.

168

168

TABLE R402.4.1.1
AIR BARRIER, AIR SEALING AND INSULATION INSTALLATION [a]

COMPONENT	AIR BARRIER CRITERIA	INSULATION INSTALLATION CRITERIA
Electrical/phone box on exterior walls	The air barrier shall be installed behind electrical and communication boxes. **Alternatively**, air-sealed boxes shall be installed.	—

 169

169

TABLE R402.4.1.1
AIR BARRIER, AIR SEALING AND INSULATION INSTALLATION [a]

COMPONENT	AIR BARRIER CRITERIA	INSULATION INSTALLATION CRITERIA
HVAC register boots	HVAC supply and return register boots that penetrate building thermal envelope shall be sealed to the subfloor, wall covering or ceiling penetrated by the boot.	—

 170

170

TABLE R402.4.1.1
AIR BARRIER, AIR SEALING AND INSULATION INSTALLATION [a]

COMPONENT	AIR BARRIER CRITERIA	INSULATION INSTALLATION CRITERIA
Concealed sprinklers	Where required to be sealed, concealed fire sprinklers shall only be sealed in a manner that is recommended by the manufacturer. Caulking or other adhesive sealants shall not be used to fill voids between fire sprinkler cover plates and walls or ceilings.	—

a. Inspection of log walls shall be in accordance with the provisions of ICC 400.
b. Air barrier and insulation full enclosure is not required in unconditioned/ventilated attic spaces and at rim joists.

171

R402.4 Air leakage

R402.4.1.2 Testing

The building or dwelling unit shall be tested for air leakage. The maximum air leak-age rate for any building or dwelling unit under any compliance path shall not exceed 5.0 air changes per hour **or** 0.28 cubic feet per minute (CFM) per square foot of dwelling unit enclosure area. Testing shall be conducted in accordance with ANSI/RESNET/ICC 380, ASTM E779 or ASTM E1827 and reported at a pressure of 0.2 inch w.g. (50 Pascals)

Exception….

 172

172

R402.4 Air leakage

Exception

For heated, attached private garages and heated, detached private garages accessory to one-and two-family dwellings and townhouses not more than three stories above grade plane in height, building envelope tightness and insulation installation shall be considered acceptable where the items in Table R402.4.1.1, applicable to the method of construction, are field verified.

Where required by the code official, an approved third party independent from the installer shall inspect both air barrier and insulation installation criteria. Heated, attached private garage space and heated, detached private garage space shall be thermally isolated from all other habitable, conditioned spaces in accordance with Sections R402.2.12 and R402.3.5, as applicable

 173

173

R402.4 Air leakage

During testing

1. Exterior windows and doors, fireplace and stove doors shall be closed, but not sealed, beyond the intended weatherstripping or other infiltration control measures.
2. Dampers including exhaust, intake, makeup air, backdraft and flue dampers shall be closed, but not sealed beyond intended infiltration control measures.
3. Interior doors, where installed at the time of the test, shall be open.
4. Exterior or interior terminations for continuous ventilation systems shall be sealed.
5. Heating and cooling systems, where installed at the time of the test, shall be turned off.
6. Supply and return registers, where installed at the time of the test, shall be fully open.

Exception

When testing individual dwelling units, an air leakage rate not exceeding 0.30 cubic feet per minute per square foot of the dwelling unit enclosure area, tested in accordance with ANSI/RESNET/ICC 380, ASTM E779 or ASTM E1827 and reported at a pressure o0.2 inch w.g. (50 Pa), shall be permitted in all climate zones for:

1. Attached single and multiple-family building dwelling units.
2. Buildings or dwelling units that are 1,500 square feet or smaller.

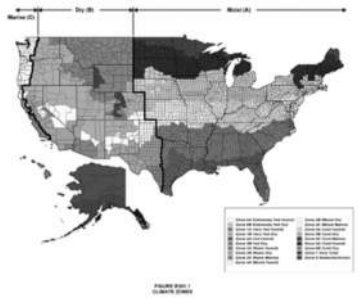
 174

174

R402.4 Air leakage

R402.4.1.3 Leakage rate

When complying with Section R401.2.1, the building or dwelling unit shall have an air leakage rate not exceeding 5.0 air changes per hour in Climate Zones 0, 1 and 2, **and** 3.0 air changes per hour in Climate Zones 3 through 8, when tested in accordance with Section R402.4.1.2.



 175

175

Montana Amendment

(g) Subsection R402.4.1.2, Testing, is deleted and replaced with the following: The building or dwelling unit shall be tested and verified as having an air leakage rate of not exceeding four air changes per hour in Climate Zone 6. Testing shall be conducted with a blower door at a pressure of 0.2 inches w.g. (50 Pascals).
Where required by the code official, testing shall be conducted by an approved party. A written report of the results of the test shall be signed by the party conducting the test and provided to the code official. Testing shall be performed at any time after creation of all penetrations of the building thermal envelope.
During testing:
"(i) exterior windows and doors, fireplace and stove doors shall be closed, but not sealed;
"(ii) dampers shall be closed, but not sealed, including exhaust, intake, makeup air, back draft and flue
dampers;
"(iii) interior doors shall be open;
"(iv) exterior openings for continuous ventilation systems and heat recovery ventilators shall be closed and sealed;
"(v) heating and cooling system(s) shall be turned off;
"(vi) "B" or "L" vents, combustion air vents, and dryer vents shall be sealed; and
"(vii) supply and return registers, where installed at the time of test, shall by fully open.

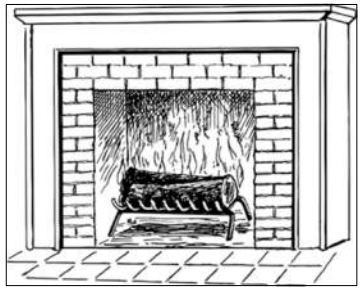
 176

176

R402.4 Air leakage

R402.4.2 Fireplaces

New wood-burning fireplaces shall have tight-fitting flue dampers or doors, and outdoor combustion air. Where using tight-fitting doors on factory-built fireplaces listed and labeled in accordance with UL 127, the doors shall be tested and listed for the fireplace.



 177

177

R402.4 Air leakage

R402.4.3 Fenestration air leakage

Windows, skylights and sliding glass doors shall have an air infiltration rate of not greater than 0.3 cfm per square foot, and for swinging doors, not greater than 0.5 cfm per square foot, when tested in accordance with NFRC 400 or AAMA/WDMA/CSA 101/I.S.2/A440 by an accredited, independent laboratory and listed and labeled by the manufacturer

 178

178

R402.4 Air leakage

R402.4.4 Rooms containing fuel-burning appliances

In Climate Zones 3 through 8, where open combustion air ducts provide combustion air to open combustion fuel burning appliances, the appliances and combustion air opening shall be located outside the building thermal envelope or enclosed in a room, isolated from inside the thermal envelope. Such rooms shall be sealed and insulated in accordance with the envelope requirements of Table R402.1.2, where the walls, floors and ceilings shall meet not less than the basement wall R-value requirement. The door into the room shall be fully gasketed and any water lines and ducts in the room insulated in accordance with Section R403. The combustion air duct shall be insulated where it passes through conditioned space to a minimum of R-8.

 179

179

R402.4 Air leakage

R402.4.5 Recessed lighting

Recessed luminaires installed in the building thermal envelope shall be sealed to limit air leakage between conditioned and unconditioned spaces. Recessed luminaires shall be IC-rated and labeled as having an air leakage rate of not greater than 2.0 cfm when tested in accordance with ASTM E283 at a pressure differential of 1.57 psf.

Recessed luminaires shall be sealed with a gasket or caulked between the housing and the interior wall or ceiling covering

 180

180

R402.4 Air leakage

R402.4.6 Electrical and communication outlet boxes (air-sealed boxes)

Electrical and communication outlet boxes installed in the building thermal envelope shall be sealed to limit air leakage between conditioned and unconditioned spaces. Electrical and communication outlet boxes shall be tested in accordance with NEMA OS 4 , Requirements for Air-Sealed Boxes for Electrical and Communication Applications, and shall have an air leak-age rate of not greater than 2.0 cubic feet per minute at a pressure differential of 1.57 psf (75 Pa).

Electrical and communication outlet boxes shall be marked “NEMA OS 4” or “OS 4” in accordance with NEMA OS 4.

Electrical and communication outlet boxes shall be installed per the manufacturer’s instructions and with any supplied components required to achieve compliance with NEMA OS 4

 181

181

SHUMS CODA ASSOCIATES

- 4610 S Ulster, Suite 150
- Denver, CO 80237

- Ph. 303-400-6564
- Fax 303-693-0630

- www.shumscoda.com
- gil.rossmiller@shumscoda.com

ICC PREFERRED EDUCATION PROVIDER

 182

182